

STONE AGE TOOLS

Their Techniques, Names and Probable Functions

Deccan College
Building Centenary and Silver Jubilee Series

1

STONE AGE TOOLS
Their Techniques, Names and Probable Functions

by

H. D. SANKALIA

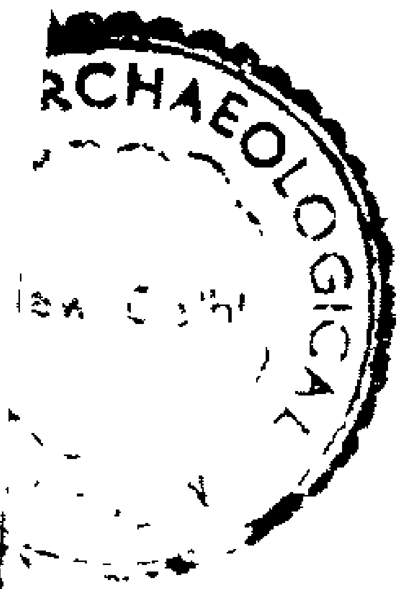
DECCAN COLLEGE
Postgraduate and Research Institute
Poona

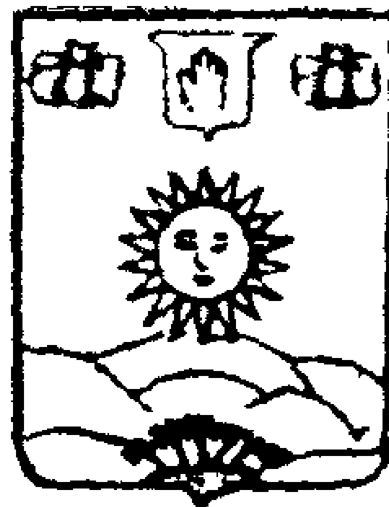
STONE AGE TOOLS

Their Techniques, Names and Probable Functions

by

HASMUKH DHIRAJLAL SANKALIA, M.A.,LL.B.,Ph.D. (London)
Professor of Proto Indian and Ancient Indian History and
Head of the History Department and Professor-in-Charge
of the Departments of Ancient Indian Culture and
Archaeology, University of Poona





DECCAN COLLEGE
Postgraduate and Research Institute
Poona
1964

Code No.: BC 81

First Edition: 1000 copies, 1964

Price Rs. 15

Printed by S. Ramu at The Commercial Printing Press Ltd., 34-38, Bank Street, Bombay-1 and Published by S. M. Katre for the Deccan College Postgraduate and Research Institute, Yeravada, Poona 6.

Printed in India

To

Our Early Ancestors
Who made us Men

Foreword

On the 15th of October 1964 the Deccan College celebrates the centenary of its main Building, and curiously enough this period coincides with the Silver Jubilee of the Postgraduate and Research Institute which, as successor to the Deccan College, started functioning from 17th August 1939 when members of the teaching faculty reported on duty. When I suggested to members of our faculty the novel idea that the centenary should be celebrated by the publication of a hundred monographs representing the research carried on under the auspices of the Deccan College in its several departments they readily accepted the suggestion. These contributions are from present and past faculty members and research scholars of the Deccan College, giving a cross-section of the manifold research that it has sponsored during the past twentyfive years. From small beginnings in 1939 the Deccan College has now grown into a well developed and developing Research Institute and become a national centre in so far as Linguistics, Archaeology and Ancient Indian History, and Anthropology and Sociology are concerned. Its international status is attested by the location of the Indian Institute of German Studies (jointly sponsored by Deccan College and the Goethe Institute of Munich), the American Institute of Indian Studies and a branch of the Ecole Francaise d'Extreme-Orient in the campus of the Deccan College. The century of monographs not only symbolises the centenary of the original building and the silver jubilee of the Research Institute, but also the new spirit of critical enquiry and the promise of more to come.

S. M. KATRE

Preface

It was intended originally to append this small monograph to my larger monograph on The Prehistory and Protohistory in India and Pakistan, *first delivered as six lectures to the University of Bombay in 1960. The idea at that time was that the readers should not be bothered with details of technique and forms of tools, while serious students, particularly Indian for whom no book on the subject is readily available, could consult the appendix. During the actual preparation, the appendix grew in various directions as the varied needs of the students were realized. The number of illustrations also correspondingly increased. Thus a separate publication—here called a monograph because it forms a part of the Institute's Silver Jubilee and the Deccan College's Centenary Publication Programme—has become necessary. This will have another advantage as well. Readers, mostly students, can have it separately, because, as mentioned earlier, no Indian publication exists on the subject, whereas the foreign ones are not easily available and even there no one book gives all that is necessary from a student's point of view. The material is spread over a number of large and costly volumes.*

It is obvious that this book owes considerably to the earlier works of Barnes, Bordes, Burkitt, Clark, Curwen, Leakey, Lowe, Movius, Oakley and Zeuner and the latest book—Ishi—by Theodora Kroeber. Still it may be said that at the Institute we have experimented on the various techniques and my colleague Dr. Z. D. Ansari (popularly Shaikh) has succeeded in preparing Abbevillian and Acheulian handaxes by stone-hammer and cylinder-hammer techniques. He can, likewise, simulate the various retouches and also manufacture microliths though some of the forms of pressure techniques described here still elude us. Our other colleague, Shri P. R. Kulkarni also manufactured a ground stone axe and used it for cutting a tree. Thus all the techniques have been tried by us. Personally I have learnt a great deal about various types of flakes

and retouches while experimenting on materials like hard dried soap or any fine-grained material. This I have tried to convey to the readers.

The problem of river terraces and raised sea-beaches is comparatively "new" to Indian students. Very few text-books on geology even refer to it. Those dealing with geomorphology illustrate the subject with foreign examples. Though periglacial terraces from the Panjab have been illustrated by De Terra and Paterson and recently by Shri Lal, none from the Peninsular India could be cited. After much thought an idealized situation was reconstructed (Figs. 3—8). This was shown to Prof. Zeuner and his pupil Dr. Wainwright (who happened to be in Baroda). Fortunately confirmation of this reconstruction was found at Poona itself and later on the Narmada. (Figs. 9A—9B) and farther south near Renigunta.

While dealing with the function and hafting of tools, it was realized that even the Early Stone Age tools like handaxes and cleavers might have been hafted, for they show clear signs of notches or waist on their side. Though this is not my original discovery, for it had occurred to Boucher de Perthes and Foote, among others, still the current view seems to be against such a theory. So evidence is cited in support of this view and the probable line of evolution is indicated (pp. 91—94 Figs. 93. 111—13).

In the production of this book, I must acknowledge my indebtedness to the authors mentioned above as well as to my colleagues Dr. Z. D. Ansari, Shri S. N. Rajguru and Dr. V. N. Misra. Prof. Wainwright kindly supplied me a drawing of the section on the Mahi at Nikora, whereas Prof. Zeuner sent a small note on terraces.

With a view to easily distinguishing drawings of actual objects or events from the suggested reconstructions, the latter have been shown in red.

The drawings, and photographs were made by my assistants in the Department, viz. Ss. S. K. Kulkarni, Y. S. Rasar, R. V. Sapre. H. S. Girme. H. J. Kumthekar and Dr. Z. D. Ansari.

The map (Fig. 132) has been prepared at my instance by Shri P. R. Kulkarni with the assistance of Shri Rajguru. Dr. Ansari and Dr. Mate have helped in the lay-out of the book. To all these colleagues, I am profoundly grateful.

I must also express my thanks to Shri Ramu, Director and General Manager, Commercial Printing Press and his staff for showing utmost courtesy in arranging and re-arranging the matter and finally producing this first work of its kind in India.

The jacket design was conceived by me and executed by our artist, Shri S. K. Kulkarni, with guidance from Dr. Ansari and others. While it depicts the past progress of man over the millennia, it looks up to the future, viz. the divinization of man himself, and not to his technological or material advancement alone.

H. D. Sankalia

Contents

List of Illustrations

I

Introduction

The study of Stone Age is intimately connected with several sister disciplines, but of these geology is the most important. Indeed, it is founded on geology and nurtured by its off-shoot palaeontology.

Geology is nothing but a story of the birth and growth of, and changes in, the earth we live on. We are primarily concerned with the latest phases of the earth's history.

Pleistocene

Geologically the age of the earth is divided into four main periods : (1) Primary, (2) Secondary, (3) Tertiary and (4) Quaternary. Each of these is further sub-divided. To the prehistorian it is the last period which is of interest because in our present knowledge it is during this period that man as the tool-maker emerged from his animal ancestry. Quaternary has two sub-divisions : Pleistocene and Holocene, meaning respectively, 'most recent' and 'recent'. Now 'Pleistocene' succeeds the Pliocene and is characterized by three features: Firstly, man or his earliest ancestor appeared during this period; secondly, the true oxen, true horses and true elephants which now figure on the earth also appeared at the beginning of this period. Thirdly, many parts of the earth were several times under a thick cover of ice for long periods which are called "Ice Ages".

Holocene

This is the second division of Quaternary and succeeds "Pleistocene", meaning "recent", the period in which we are living. It symbolizes the end of extinct types of animals, and the appearance of domesticated dog, sheep and cattle.

II

Stone Ages

Palaeolithic

It was customary for a long time—nearly 100 years—to designate the earliest times when man used stone tools as "Palaeolithic", meaning thereby "Old Stone Age".[1] This was later distinguished from comparatively recent times when another kind of stone tools. viz. ground or polished, were used and therefore termed "Neolithic" or "New Stone Age". In between these came another period, suggesting both a stratigraphic and cultural stage, called "Mesolithic". In Western Europe and Africa, the Palaeolithic was again sub-divided into Lower, Middle and Upper, but all the three forming the Old Stone Age, or the division is into : Lower Palaeolithic (primitive), Lower Palaeolithic (evolved) and Upper Palaeolithic.[2]

Stone Ages

The usage is now being given up (because it suggested that there was everywhere an established or fixed stratigraphic context). Instead, the entire Stone Age is divided into Early, Middle and Late —a separate category being made for the Neolithic, it being understood that in the former, throughout its three sub-divisions, man was a hunter-fisher and collector of food and using gradually more and more specialized tools, whereas in the latter he had begun to produce his own food, and specialization in other fields was also being tried.

However, there are books which employ both the terminologies,[3] whereas in South Africa, it is now fashionable to call the Early Stone

1. BURKITT, Miles, *The Old Stone Age* (3rd ed. London, 1955).
2. *The Dawn of Civilization* (Thames and Hudson, 1961), p. 20.
3. ZEUNER, F. E., (*Dating the Past*, London, 1950, pp. ix-xiii) who seems to use the term Middle Stone Age in the case of Mesolithic.

Age as "Earlier Stone Age" with a view to distinguish it from its slightly later manifestation termed "First Intermediate Stone Age".[1]

The Upper Palaeolithic in Europe is now also called "Advanced Palaeolithic".

Terminology

Though all these usages have some justification or the other, it is all confusing to a beginner, and particularly so in India, where this subject is still in its infancy. Hence with a view to simplify the issue, a provisional terminology was recommended by the First International Conference on Asian Archaeology which met in New Delhi in 1960. Accordingly, the Stone Age in India was sub-divided into Early, Middle, and Late, a separate category being made for the Neolithic.

Early Stone Age

The term "Early Stone Age" covers the conventional Lower Palaeolithic types and includes in the Indian context, the main peninsular Chelles-Acheul complex of handaxes and cleavers and the extra peninsular Sohanian and Banganga assemblages.

Middle Stone Age

The term "Middle Stone Age" covers the widely distributed group of industries consisting of scrapers and blade-flakes, from Nevasa and Maheshwar, Waingana etc. At present they cover the industries being described as Series II.

Late Stone Age

The term "Late Stone Age" covers the range of microlithic industries such as those of the Teris, Singrauli, Birbhanpur, Langhnaj etc.

Neolithic

For the Neolithic, at least, it was indeed necessary to coin (as one member of the Committee thought) a culture-historical term such as "Food-producing Stage", but the Committee ultimately retained the term "Neolithic" as it was deeply entrenched and understood. Provisionally, it is said to include "the polished axe

[1]Clark, J. Desmond, *The Prehistory of Southern Africa*, (Pelican, 1959)

stage of India". One should qualify this expression by adding the words "the beginning of the polished axe stage of India", for later even the metal-using cultures continue to employ such axes.

Tools of Stone

Whether we employ this term or that the one thing that we are concerned with all the time are tools and weapons of stone, because largely these alone have survived, tools and weapons and objects in other materials having perished.

The account of the various techniques employed during this long period—which according to a new method of dating may run over a million-and-a-half years in East Africa—is given here according to the sub-divisions of the Stone Age believed to have obtained in India, so that the material development of man from stage to stage could be followed. We begin with the Early Stone Age. Its character has been briefly indicated above.

Artifact

Instead of using the term "stone tools", it would have been better to have used the term "artifact", for an artifact means anything made by man. For several reasons this is avoided. First, it is the aim to describe here some essential concepts and terms which a beginner in Prehistory so often comes across. Secondly, the emphasis is on stone[1] tools only, while during the later periods of the Stone Age, many other objects of bone, antler, shell etc. are found. Had the term artifact been employed, one might also expect some reference to these objects.

1. Recently ZEUNER has proved by scientific tests that even the clay balls found at Achenheim (Alsace in W. Europe in the ancient deposits were made by man in the Lower Palaeolithic period. See ZEUNER, F.E., "Loess Balls From Lower Mousterian of Achenheim (Alsace), in *JRAI,* (1953), pp. 65-70.

III

Relative Dating by Natural Phenomena

Whether we refer to the object by the term "tool" or "artifact", the first question the discoverer asks himself is "How old is it?" Until about 1830 there was no way of even approximately knowing the age of a stone tool—a thing which we seem to guess so easily[1]. However, when the geological principle of uniformitarianism was accepted, the basic notion of stratigraphy which guides geologists came to be applied to archaeology, particularly prehistoric. Later it was extended with fruitful results to other periods of archaeology as well.

Stratigraphy

"Stratigraphy" means the order of succession of strata or layers. This may be in a bank overlooking a river or sea cliff, rock shelter or cave or in a natural or artificial mound. Usually the topmost layer is the last or the latest to be formed, and the lowermost, first or the earliest. Of course, there are a number of ways in which the process in nature might be disturbed or even reversed. However, assuming that everything is normal, a tool found in the lowermost layer will be the earliest in date, and those found in the subsequent layers will be respectively later.

Now when we examine a river cliff or deposits along a river bank, which is the most likely place to find an Early Stone Age

1. In this section a few of the most constantly recurring methods are discussed. For others, see ZEUNER, F.E., *Dating the Past,* 1958 Edition. With the newly discovered potassium-argon method, the tools associated with the Zinjanthropus *boisei* at Olduvai Gorge were dated to 11,70,000 years. But Dr. LEAKEY is no longer certain of this association. LEAKEY, L.S.B., *The Progress and Evolution of Man in Africa* (Oxford University Press, 1961), p 45. (See p. 106)

tool in India, we find *(from bottom upwards)* a succession of layers like this :—

Soil (This is generally blackish in Malwa, Maharashtra and Karnatak)

Brown silt
Greyish fine gravel
Brown silt
Blackish or greyish gravel
Rock (bottom).

Terraces

This simple-looking phenomenon represents the whole life history of the river. It is as follows. Once a river is formed, either by tilting of the land surface or owing to earthquake or earth movement or other natural forces, it begins gradually to cut its bed. This bed might have been composed of rock or gravel or silt. Whatever it be, this erosional activity forms the initial terrace. It is also called the "degradational or erosional terrace". Later owing to various causes (explained below), the river bed might get filled up and the river has to change its bed leaving its filled-up or older bed. The latter will be naturally at a higher level and will form another terrace. This is also called "aggradational terrace".

"In a mature river valley the rate of erosion varies along different parts of its course. The gradient slackens off as the river approaches the sea because deepening of the middle and upper reaches continues, whilst very little lowering of the last portion is possible since it is already nearly down to sea level. It very often happens that the load becomes too much for a river as it comes into these regions of slower movement. Consequently it deposits a considerable fraction of the material it is moving. It generally does this over the width of its bed and on the insides of the meander bends. A deposit of sand and gravel, called "alluvium" is thus in time laid down over the width of the valley and is called the "flood-plain". It can be up to 20 or more feet in thickness.

Should the upper reaches of the river be raised by tectonic movements, fresh impetus is given to the river and it begins actively to erode its bed, easily cutting through the sands and gravels of the flood plain and more slowly through the underlying rock. The remains of the flood plain material left on either side of the eroding river at higher level than the new flood plain that is being formed, are called "terraces".

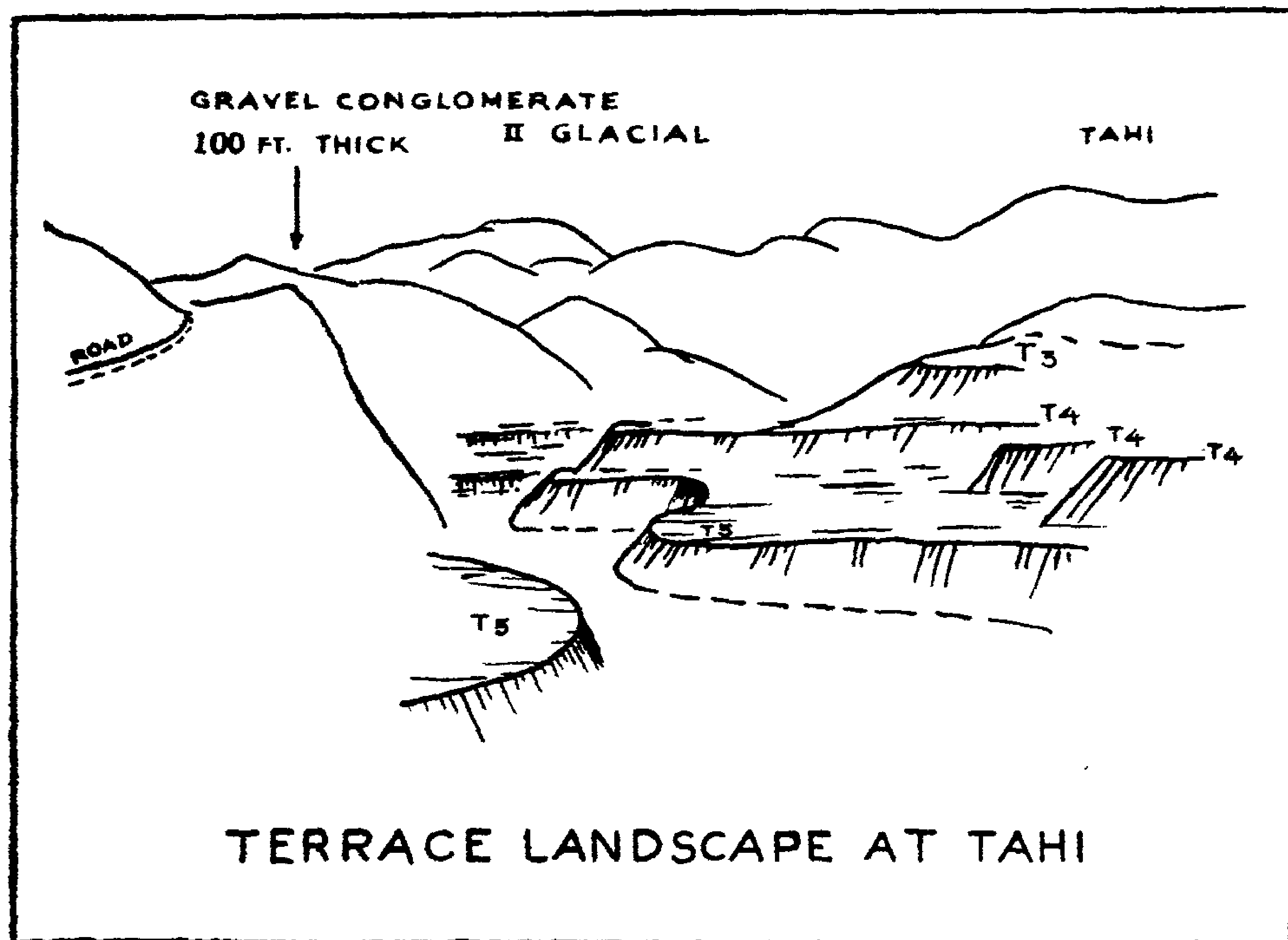


Fig. 1 Terrace Landscape at Tahi. West Panjab. Pakistan

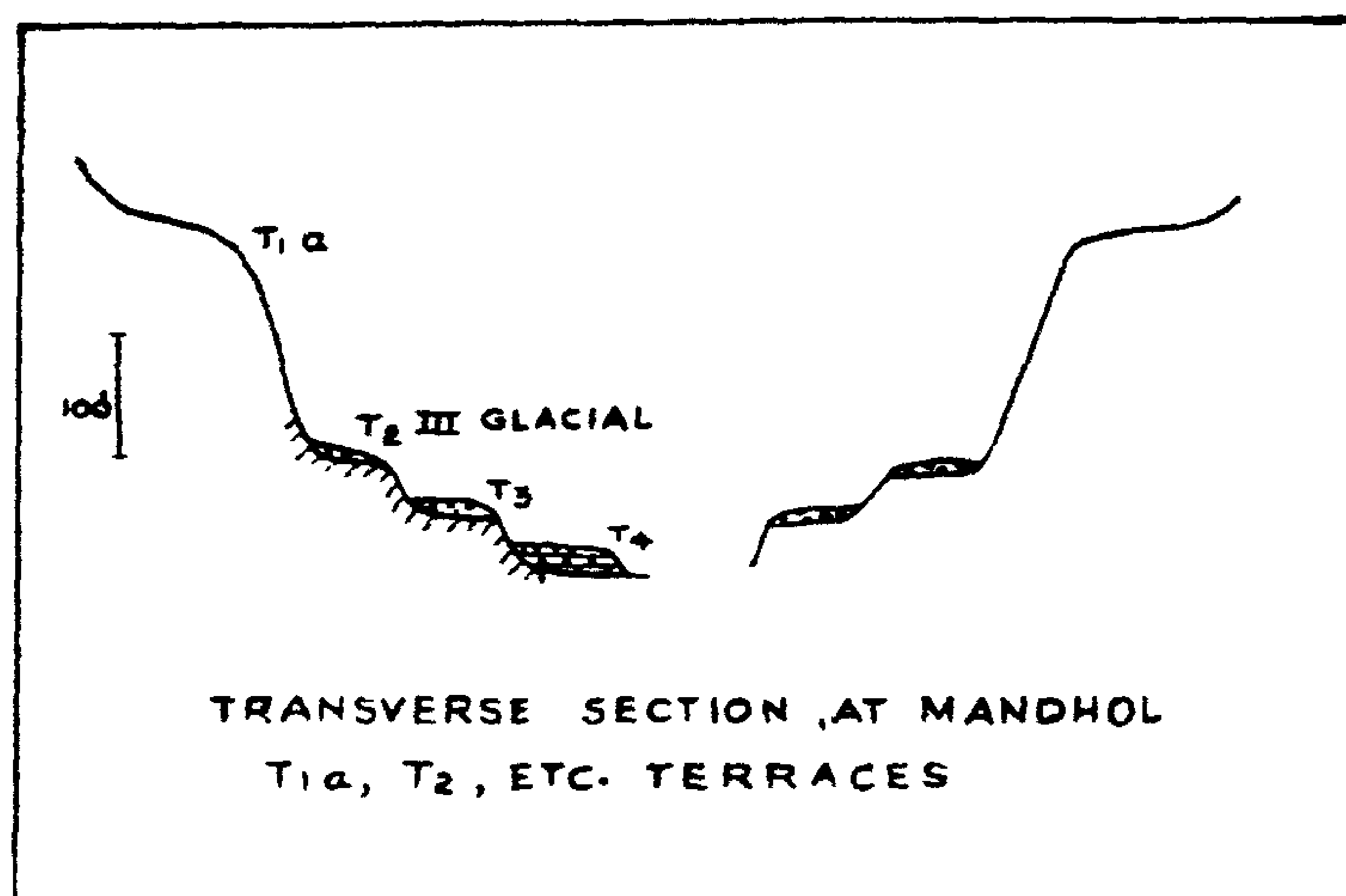


Fig. 2. Transverse section at Mandhol, West Panjab

At the seaward end of a river, a similar impetus can be given to the erosion power by a lowering of the sea-level due to a glacial phase. The river then starts eroding its bed back from the mouth

upstream, again cutting through its flood-plain and leaving terraces on either side. A subsequent rise in sea-level will fill up the estuary to the height of the sea-level during the interglacial phase and this material will be left as a terrace when the river again starts eroding during the next cold period.

In the upper reaches of the river, however, away from the effects of the rise and fall of sea-level, the situation is reversed. Here aggradation takes place during the glacial phase when solifluction material is deposited in the river valleys and erosion takes place in the interglacial phase when there is again sufficient water to cut through the accumulation of debris. This has been well illustrated by the study of the Indus, Sohan and other rivers of the Panjab. (Figs. 1 & 2).

In each case, therefore, although the material of the terrace is laid down during an aggradational period, the actual terrace is formed only when erosion takes place.

In tropical countries, however, interglacial conditions would correspond to humid phases and glacial conditions to dry phases"[1]

In this way erosion and aggradation as well as earth movements might make several "steps", "levels" or "terraces" along the river. It is for the Pleistocene geologists and prehistorians to understand their formation and relationship. Generally, the highest terrace is the oldest, and the lowest, the youngest, as will be clear from the accompanying diagrams. But in practice it requires prolonged observation and systematic study of a river to decide the age of and relationship between the terraces.

Thus though one may find a stone tool away from the river in a layer which appears to be higher (Fig. 8, 2) and hence later, it is in fact the first to have been deposited by the river. (Fig. 3). After having done so, the river moved away from it leaving it high and dry. Subsequently, the river never attained this height but in a wet phase laid down its load at a lower height. This was also cut. (Fig. 4). Thus one may observe two or more terraces, particularly where the river meanders or forms a crescent or even a horse-shoe bend.

The formation of the river terraces has been explained above. Generally, the top-most terrace is the oldest, and the lower ones comparatively young.

Actual observation in a large number of river valleys in several parts of peninsular India, however, shows the tools of the Early Stone Age—handaxes, cleavers, pebble tools etc.—lying in a hard

[1]Contributed by the late Professor ZEUNER.



Fig. 9 A. Section on the right bank of Mutha river, near Datta Wadi, Poona. It shows present erosional phase after two aggradations.

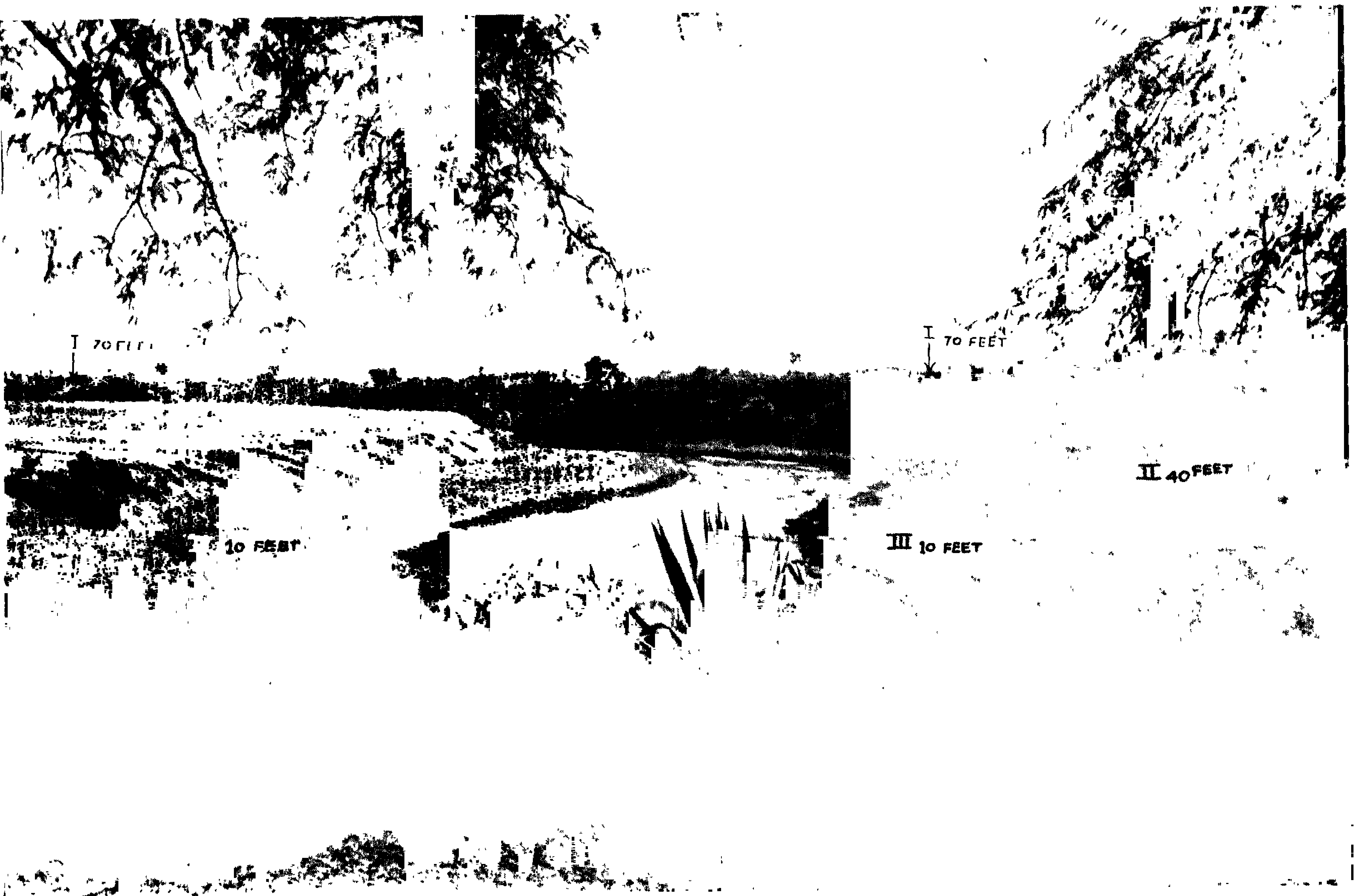


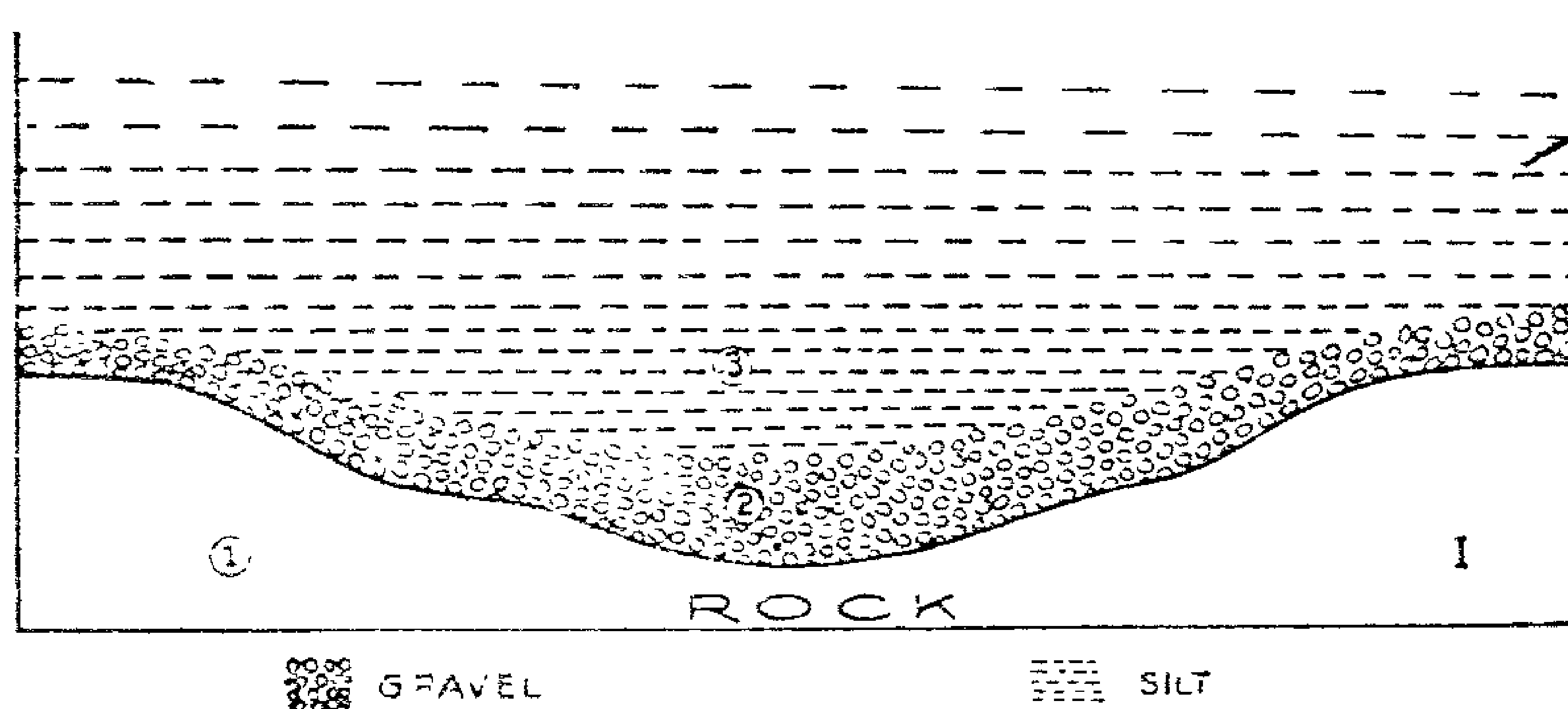
Fig. 9 B. Three "terraces" on the Narmada, opposite Saguna Ghat. Dist. Narsimhapur, M.P.

cemented gravel, almost on the present river bed, or a little above it. This gravel bed is found capped by other deposits like silt, fine gravel, silt etc.

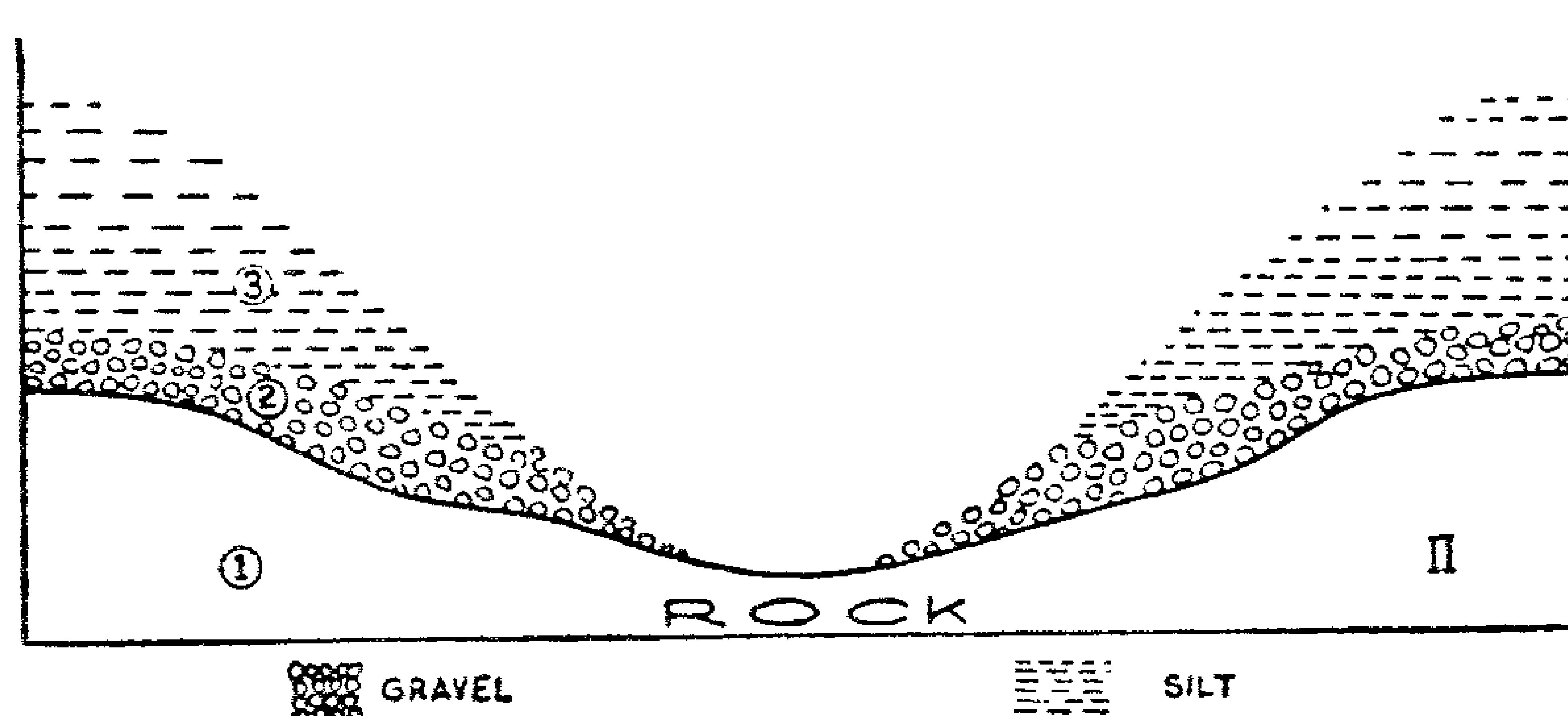
Naturally students get confused, particularly those who have witnessed the well-formed sequences of terraces in Europe or the Panjab, at this inverted order of the occurrences of tools.

The explanation seems to be as follows.

In India, as in Europe, the oldest terrace is the highest, but this is rarely seen, and is covered by silt, which is but a part of the one and the same cycle of formation, but showing a difference in climate. What seems to have happened may be illustrated by a series of diagrams. Initially (I), Fig. 3, when the river begins to flow, it gradually lays down its load of pebbles and silt, and we have to suppose that (owing to a drier climatic phase) the whole river bed got filled up. The river, if at all present, might be flowing in a small streak on one side, or the middle of the aggraded bed. (See p. 106)



In the second stage (II), Fig. 4, this deposit gets cut or eroded.



Figs. 3-4 Formation of River Terraces in Peninsular India, Suggested Reconstructions

During the third stage (III), Fig. 5, the process re-starts and the river bed is again filled up, *but this time by a slightly different kind of gravel and silt.*

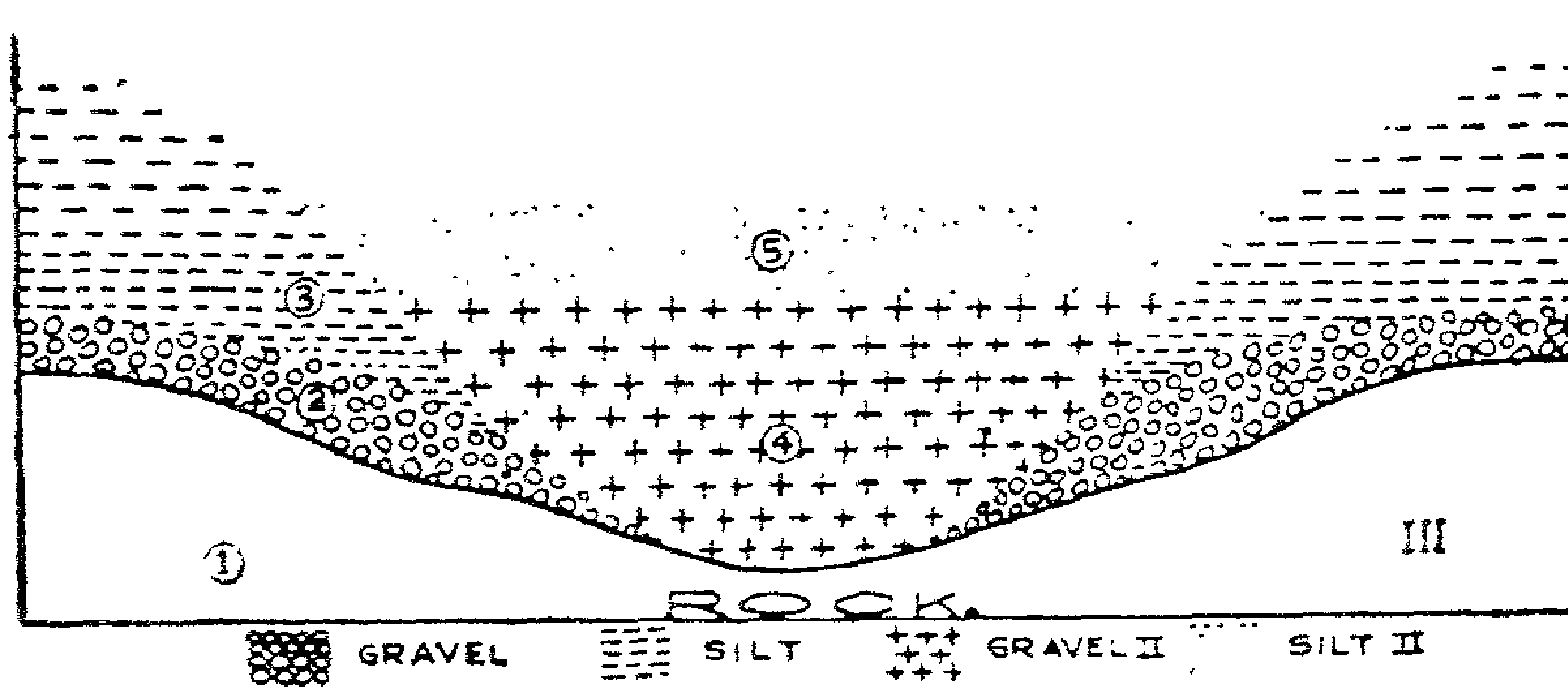


Fig 5

Erosion once again exposes the deposits (IV), Fig. 6, but now the older deposits are not easily visible.

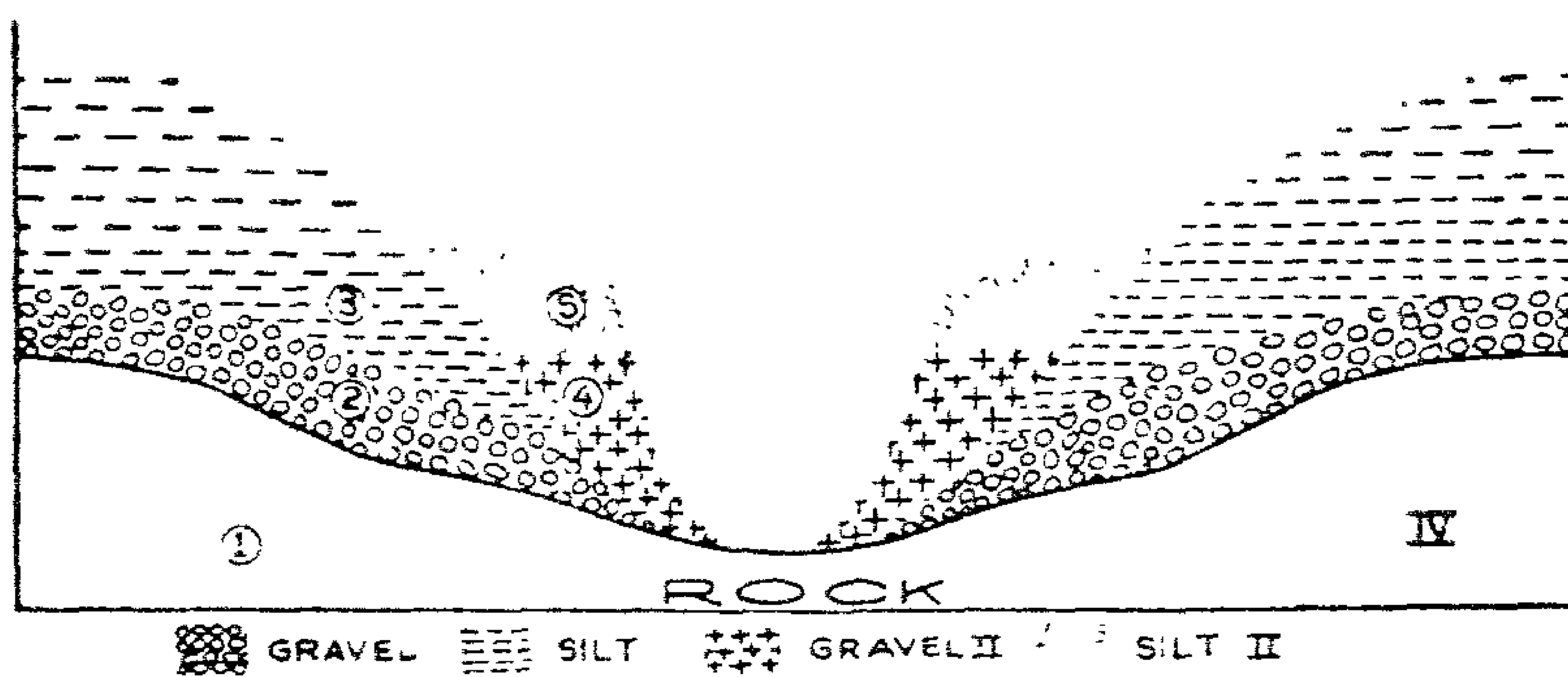


Fig. 6.

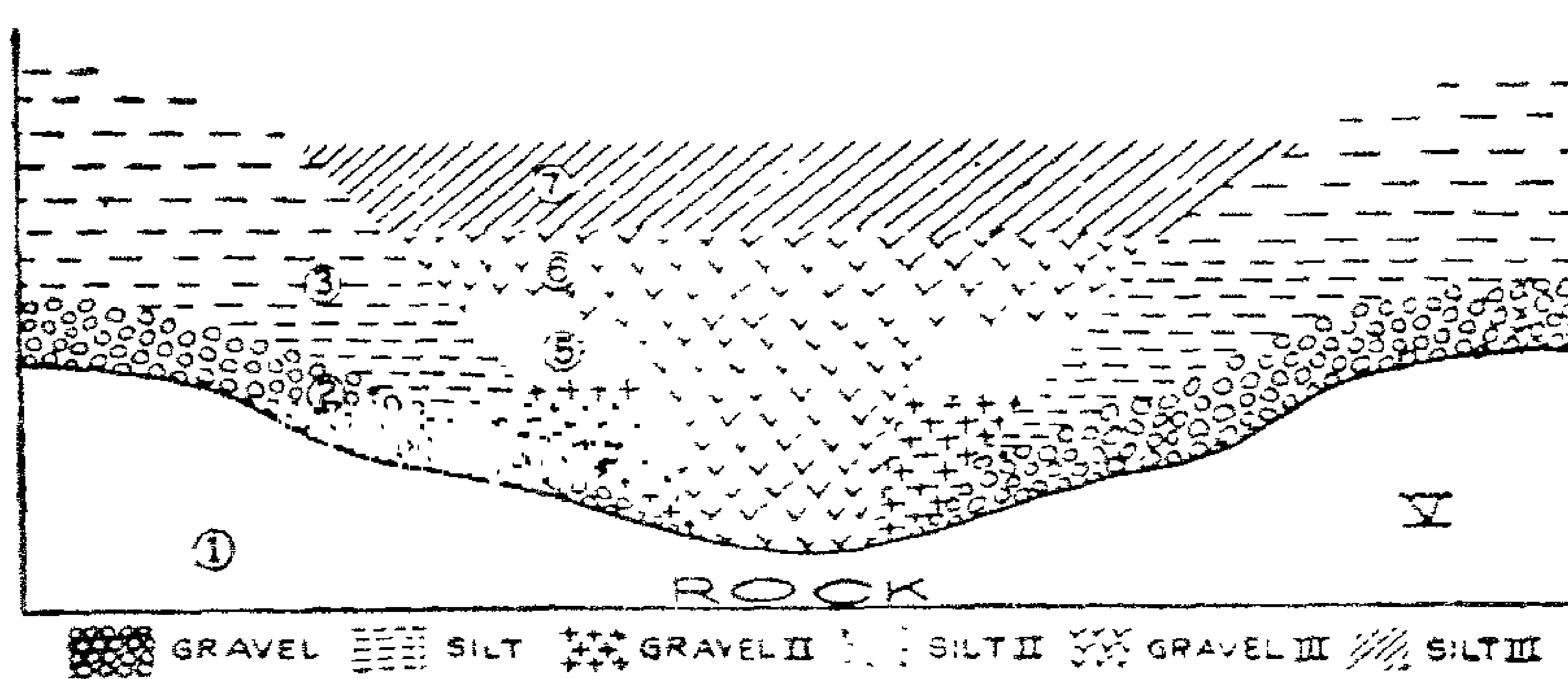


Fig. 7.

The present condition is reached in stage VI, Fig. 8.[1] Thus there are three aggradational and three erosional phases. It should be noted that *wherever* all the six stages or a majority of them survive, the river bed will be considerably narrower than it was in the first stage, when the river began to flow on the virgin land surface.

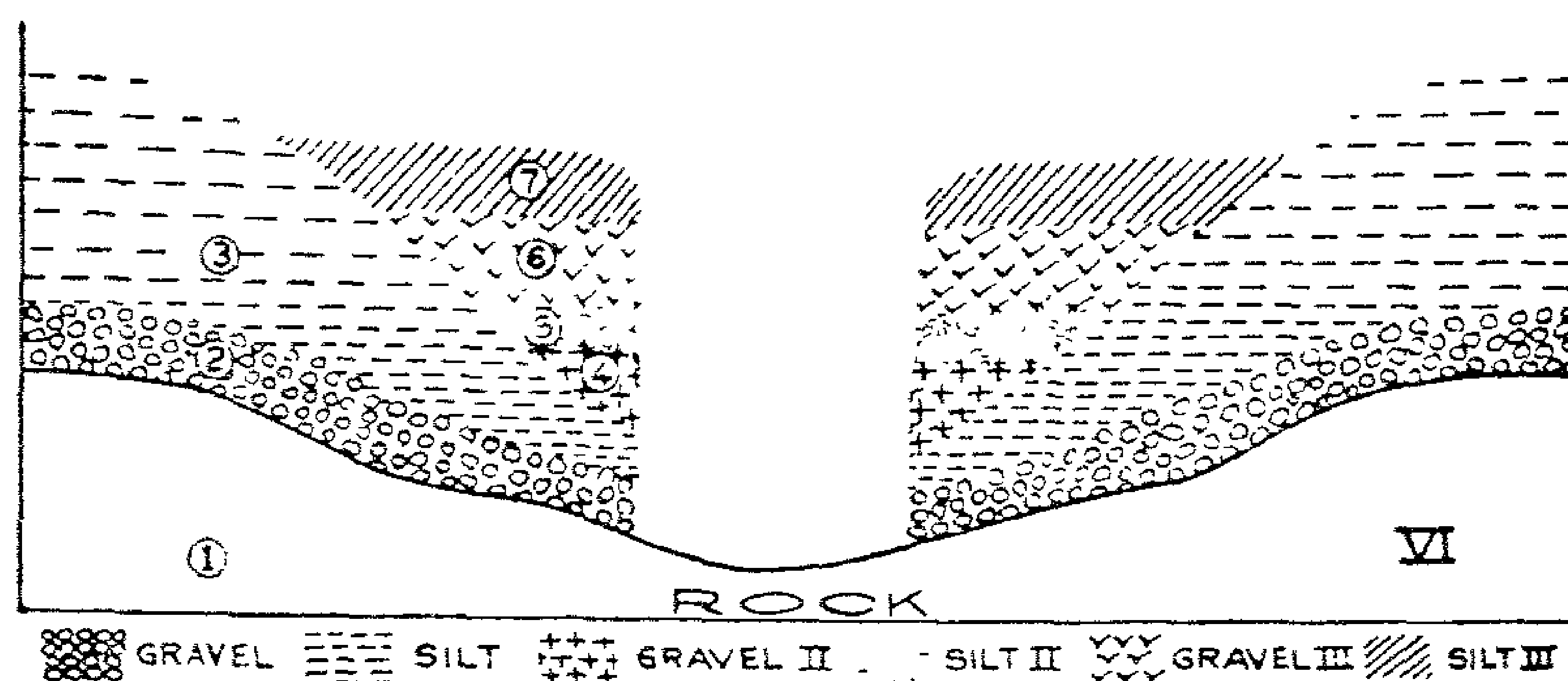


Fig. 8.

In support of this idealized diagram may be cited two actual phenomena seen recently by the writer on the river Mutha at Poona (Fig. 9A) and near the Saguna Ghat on the Narmada, District Narsimhapur, Madhya Pradesh. (Fig. 9B). The Mutha first deposited a pebbly rubble gravel on the rock. (Fig. 9A). This gravel is nearly 10 ft. in thickness. Over it was laid a brownish silt of about 25 ft. Thus when this cycle of gravel and silt was completed, the river flowed at a height of 35 ft. above its present bed.

The river then cut these deposits in the first erosional phase.

In the second aggradational phase the river now deposited a *fine sandy gravel* and a part of the older washed out pebble gravel. This was followed by a capping of light grey silt.

However, during this aggradation the river could not reach the old height of 35 ft. and therefore both the gravel and silt were deposited against the older deposits. These have survived wherever these were laid in hollows, as at Datta Wadi near Poona, but elsewhere have mostly been eroded.

The difference in texture and colour between the two gravels and the silts is well-marked and apparent to the naked eye. The older gravel is pebbly and well-cemented and it as well as the thick silt deposit are weathered orange-brown. The younger deposits are lighter in colour, sandy, not well-cemented and characterized by cross-bedding.

1. The deposits 6 and 7 of the last aggradation should not normally lie over those of the third stage, but should lie at a lower level, forming thus a low terrace.

The Narmada had witnessed at least three cycles of aggradation and erosion. (Fig. 9B). Nowhere all the deposits have been preserved, but at Saguna Ghat one may see some of these in three distinct terraces.

All the old deposits are not visible. We see only the silt of the second aggradation which forms the top terrace. Against this, some 30 ft. lower down, we see the second terrace. Its cemented gravel, nearly 20 ft. thick at places, can be seen on both the banks. This was also eroded, and its place was taken by a still younger deposit of blackish silt, now forming a terrace at 10 ft. from the water level.

Ice Age

This signifies a period in earth's life, when huge sheets of ice which are at present confined to very high altitudes on the Alps and the Himalayas and around the North and South Poles known as the Arctic and Antarctic respectively had come down to much lower altitudes—for instance near Rawalpindi in the Panjab or Paris in France.

There were a number of such Ice Ages in the past. During one of these even the present Nilgiris were capped by ice sheets. *However, it is the Ice Ages during the Pleistocene which are important for the study of prehistory,* because these alone are contemporary with man and his tools.

It has now been ascertained that there was not one continuous Ice Age, but at least four sub-phases, known as glacial periods, separated by three warm periods known as interglacial periods. Initially four stages known as Gunz, Mindel, Riss and Wurm, named after four small Alpine rivers in Central Europe, were recognized by PENCK and BRUCKNER. The interglacial periods are called respectively Gunz-Mindel, Mindel-Riss and Riss-Wurm. Glacial and interglacial periods also have been traced in Northern America and North India. Further work in Europe has shown that the cold and warm periods did not have a uniform climate throughout their duration, but were intervened by warm and cold periods respectivley of smaller duration. These minor phases are known as Interstadial and Stadial respectively. The sequence of Pleistocene climatic phases as worked out for Europe is given on p. 16.

The available evidence indicates that the number of glacial and interglacial phases in all the continents was not similar or at least identical evidence has not been found everywhere. For instance, in Scandinavia the earliest glaciation is Elster which is equivalent to

the Mindel, not Gunz, of the Alpine area. The use of European terminology for all these areas is likely to create confusion. So a terminology independent of European or any other nomenclature and capable of universal application has been evolved. It is given in column 5 of the above chart.

Fig. 9 illustrates the extent of the four Ice Ages in Kashmir.

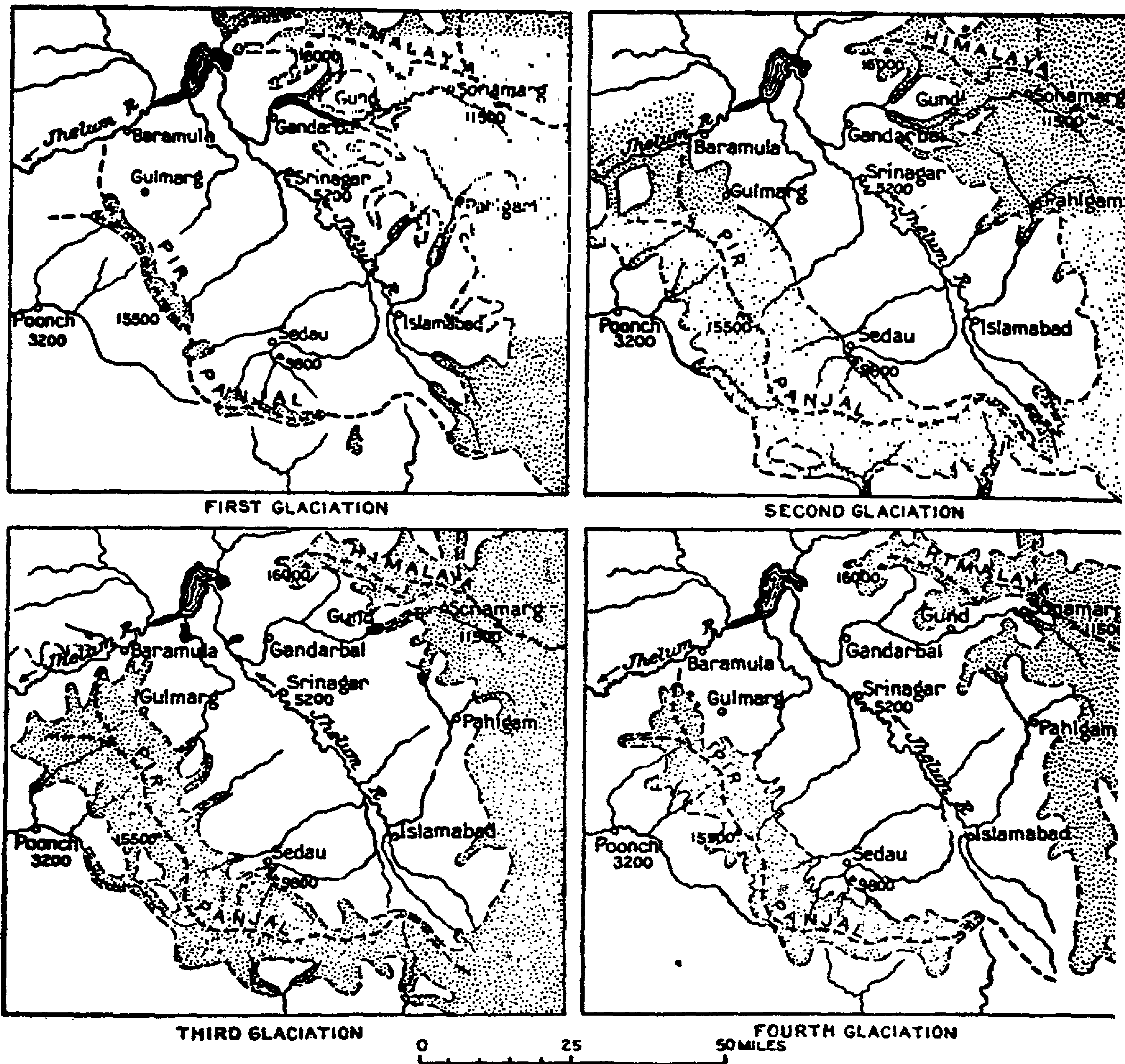


Fig. 9. Ice Ages in Kashmir, showing the extent of Four Glaciations.

Raised Sea Beaches

As mentioned above, the level in the sea also falls or rises, due to various causes, the chief being the formation of ice sheets during the periods of extreme cold, known as "Ice Ages", and the melting of snow during warm periods, called "Interglacial Periods".

Something of this phenomenon is yearly witnessed in India, where during the cold season lasting from November to February, the Himalayan rivers bring down much less water, but during the hot season, the snow melts, and we have floods which naturally should swell the sea level. But this may not in fact happen, if elsewhere the rivers carry less water. So, for a general rise in sea level, the melting of snow has to take place on a very large scale, all over the world, but particularly in the cold and temperate countries.

Likewise the fall in sea level is caused by the reduction of the water in rivers in temperate countries owing to the formation of ice sheets in the middle and upper reaches of the river.

Now the evidence of this phenomenon is preserved in the river banks near their estuaries, where the rivers meet the sea. And a very experienced eye could detect the various changes by studying the section of a river near its estuary. Thus, for instance, at Dabka on the Mahi, and at Nikora on the Narbada, Professors ZEUNER and WAINWRIGHT respectively have noticed the effect caused by the lowering of the sea level, and the consequent fall in the river level. The section on the Narbada, the writer had an opportunity to see with the late Dr. SUBBARAO and Professor WAINWRIGHT (Fig. 10). Very briefly what has happened is this: There is nearly a 100-feet high section on the left bank of the Narbada at this place. While the lowest layers are not clearly visible, as they are covered by *talus*, the upper 60 ft. or so show at least two reddish brown layers, separated by yellowish silt. These also dip down towards the sea. The reddishness is interpreted to have been caused by the fact that at this time the river level had gone down and the then land surface was exposed to weathering.

At the subsequent rising of the sea, as well as the river, this land surface might have been submerged under water. But now this and other similar older land surfaces are once more exposed, because the river at present has cut down its bed almost to the bed rock. (See p. 106)



Fig. 10A Rock shelter called Abchand, overlooking a thick forest and a stream, on the Sagar-Jabalpur Road, M. P.

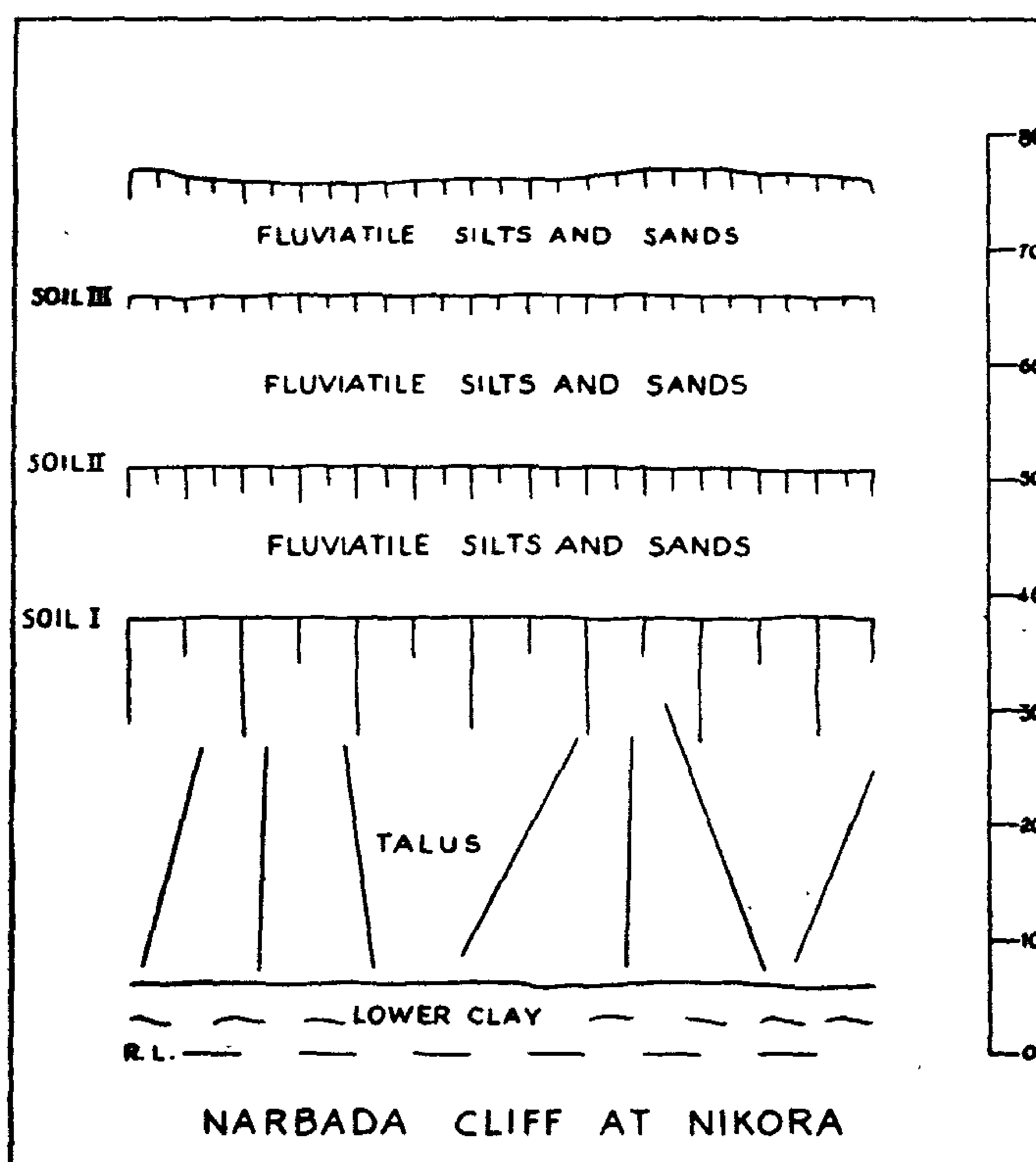


Fig. 10. Narbada Cliff at Nikora, showing three fossil soil horizons.

Rock-shelters

Very few rock shelters and caves have been excavated in India, and it is therefore not possible to cite a "local" example. But there are a large number of them in the sandstone and limestone regions in Madhya Pradesh, Uttar Pradesh and Andhra. Of these, a few have been seen by the writer. (Fig. 11). Briefly, if a cave or a rock-shelter is inhabited by man, some kind of debris, the refuse of his food, bone, shells, ash and earth gradually get collected. The site may, then, for some reason or other, be abandoned. If this period of desertion is long, a sterile layer of earth may be formed over it. The same men or other group of men might visit the cave again. They will leave their trail behind. Thus in course of time, the cave or rock-shelter might get fairly filled up. The deposit will not be uniformly thick. It will be greater in thickness in the more open spaces and will thin down as we go into the interior where the cave roof slopes down to the floor. When these debris are excavated, they will show the sequence of deposits. This indicates a relative time-table of events

Mono-glacialism	Biglacialism	Penck and Bruckner		Detailed relative chronology	Abbre-viations
Ice-Age	Second glaciation	Fourth Alpine glaciation "Würm"	Last Glaciation	3rd glacial phase	LGl_3
				Interstadial oscillation	$LGl_2/_3$
				2nd glacial phase	LGl_2
				Interstadial oscillation	$LGl_1/_2$
				1st glacial phase	LGl_1
		Third Interglacial	Last Inter-glacial	Second part of interglacial	LIgl
				Minor cool phase	
				First part of interglacial	
		Third Alpine glaciation "Riss"	Penulti-mate Glaciation	2nd glacial phase	PGL_2
				Interstadial oscillation	$PGl_1/_2$
				1st glacial phase	PGl_1
	Only interglacial	Great Interglacial		Great or Penultimate Inter-glacial with one or several cooler phases	PIgl
	First glaciation	Second Alpine glaciation "Mindel"	Ante-penulti-mate Glaciation	2nd glacial phase	ApGl½
				Interstadial oscillation	$ApGl/_2$
				1st glacial phase	$ApGl_1$
		First Interglacial		Ante-penultimate Inter-glacial	ApIgl
		First Alpine glaciation "Günz"	Early Glaciation	2nd glacial phase	EGl_2
				Interstadial oscillation	EGl½
				1st glacial phase	EGl_1
Pliocene	Pliocene	Pliocene		Villafranchian (Pliocene)	

Fig. 10B. Chart showing climatic fluctuations in Europe during the Pleistocene

and helps in knowing the age of the tools or other artifacts associated with each layer. (See p. 106)

Of these the most important are remains of animals which are now extinct, *that is no longer living on the earth.* The geologists and zoologists have found by a study of the teeth, horn-cores and other important bones of the body that animals like the ox, horse, elephant rhinoceros and many others have gradually evolved. This change in limbs and particularly teeth can be related to certain important geological strata, meaning thereby that such animals were living when that geological formation was taking place. Thus once again a relative sequence of events in the past has been prepared.

Now if stone tools are found in association with such extinct or fossil animals, then they can be assigned that date. To the prehistorian, however, the most significant are the environmental factors behind this evolution. The change in limb bones and particularly teeth is closely related to the climate and other environmental conditions prevailing at the time when these animals were living. Thus a study of them gives a sequence of environmental changes that took place during the period of the cave's occupation. Such a sequence gives an independent chronology for the artifacts found associated with the bones in different layers. Besides, the knowledge of environmental conditions during any period of man's history is itself of great interest to archaeology. This science of extinct animals is called "Palaeontology" and that of early environment "Environmental Archaeology".[1]

1. An admirable booklet on this is recently published by ZEUNER, *Environment of Early Man with Special reference to Tropical Regions.* Baroda, 1963.

IV

Techniques

By far the largest number of prehistoric objects called usually artifacts, because made artificially by man and not by nature, consists of stone tools or implements and weapons, though there is little doubt that man used also wood, shell and bone.[1] Next in order is pottery or vessels of clay which are baked by sun or fire or both. Various processes, "techniques", must have been employed in fashioning these. But these latter fall outside the scope of the present study. Since these artifacts are far removed from us in time, the likely methods used by the Stone Age man or his successor have to be inferred in several ways.

(a) First, by studying the stone tools themselves;

(b) Secondly, by trying to imitate them today;

(c) Thirdly, by observing primitive or semi-primitive people in a comparable cultural stage making similar tools and using them.

Early Stone Age

Since for the earliest conceivable period when man is known to exist only tools of stone are found, it is rightly inferred that these tools were made without the help of any metal, as this was unknown. The earliest tools so far known consist of pebbles, one side of which has deep hollows or flake scars. By observation and experiment, it has been found that such deep scars result either by:

1. Dr. Dart even postulates an "age of bone", when the giant apes and other semi-men used the bones of various animals as tools. (*Illustrated London News,* May 9, 1959). In a very recent article (*Illustrated London News,* December 29, 1962, pp. 1052-55), Dr. Dart claims to have discovered the most primitive of tools made of stalactite in the limestone cave at Makapansgat valley in South Africa by the Australopithecines.

(i) striking a block of stone against another (stationary stone known as anvil); or

(ii) striking a block of stone or pebble in one's left hand with another block or pebble in the right hand.

The former is called "Block-on-Block" or "Anvil" method; and the latter "Direct Percussion" method. Each of these may now be described in a little more detail.

Anvil or Block-on-Block Technique

In this the pebble or block of stone which is to be broken for further use is itself hit against the projecting point of a large, fixed block of stone or anvil.[1] Usually, large flakes with prominent bulbs,

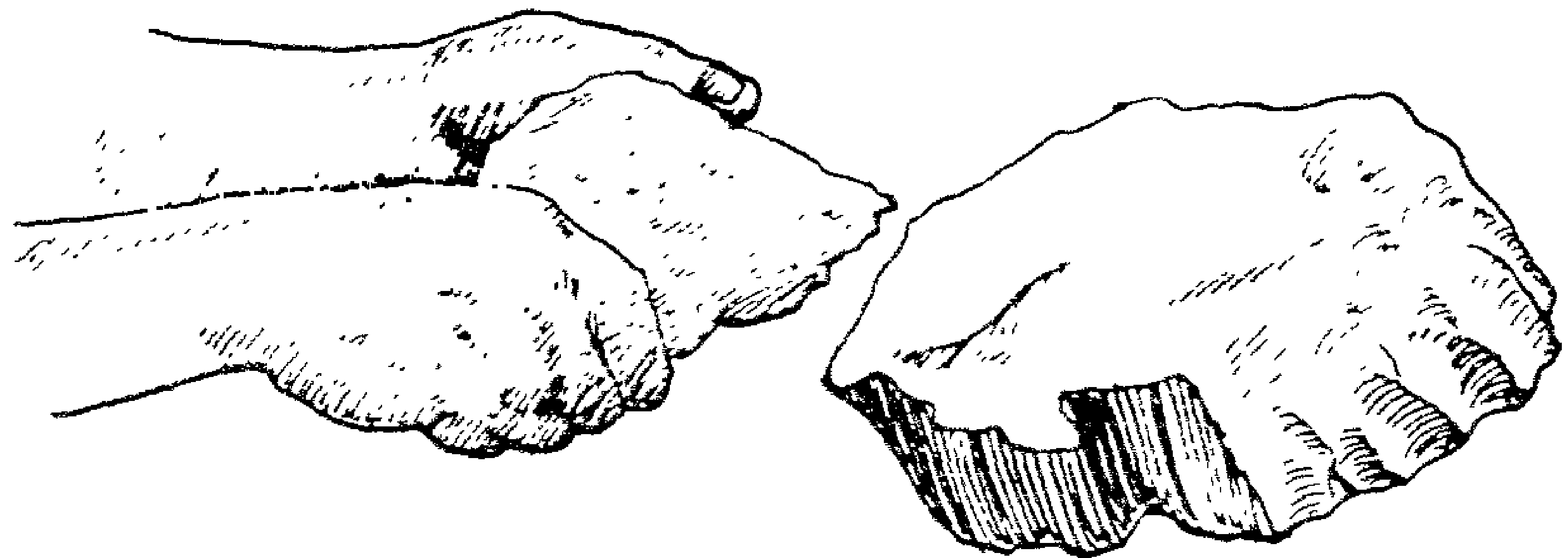


Fig. 11. Anvil or Block-on-Block Technique

which we find in the Narbada and the Early Sohan (and also the Clactonian) were probably obtained in the manner postulated by the Abbe BREUIL or LEAKEY. According to BREUIL, the block of stone from which a really large flake was to be removed was tied to the end of a leather thong, the other end of which was fastened to a rough wooden tripod, and that the block was swung like a pendulum against the anvil. LEAKEY doubts the accuracy as well as the commonness of this method.

Direct Percussion or Stone Hammer Technique

This was the most common method likely to be employed *at any time* and anywhere in the world. In this the pebble or nodule which is to be made into a tool will be kept in the right or left

1. LEAKEY, L.S.B., *Adam's Ancestors*, London, 1953, pp. 40-1.

hand or on the right or left knee (after suitable padding) of the maker. (Fig. 12). At times the trunk of a tree might also be chosen.

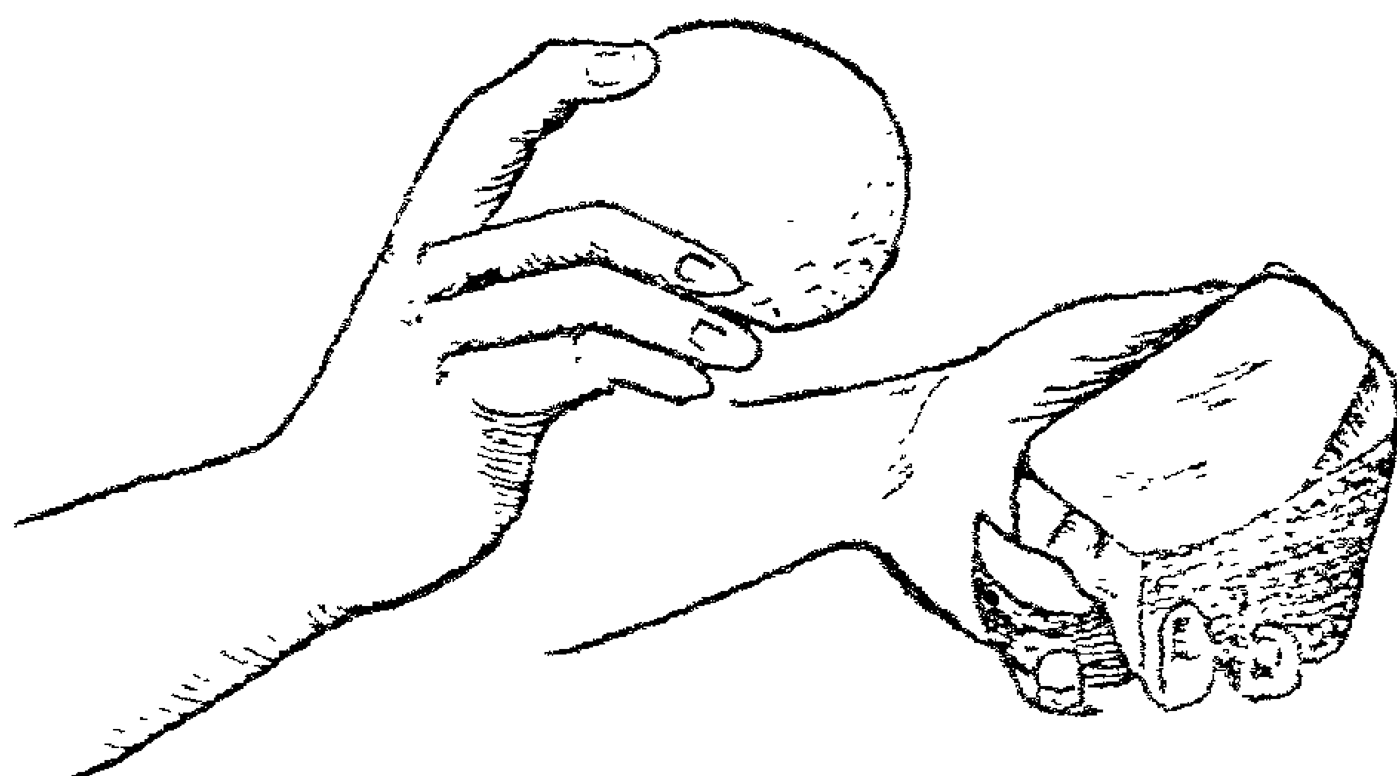


Fig. 12. Direct Percussion or Stone Hammer Technique

The idea is (without going into the details or mechanism of shock-absorption which are admirably illustrated by LEAKEY) to abosrb the shock of the blow given by the hammer. Then with a pebble of suitable size and weight, the man gives a blow near the edge or the periphery of the larger pebble. "This block was at an angle of roughly 120° to the direction in which he desired to remove the flake, and also at a point near the edge from which the flake was to be detached. In this way only a part of the cone of the force penetrated the stone........Thus a flake was detached with a well-marked semi-cone or bulb of percussion marking the point of impact of the hammerstone".[1] *It is to be noted that a chip will come off not from the surface on which the blow is given, but from the lower surface.* Then to remove another flake from this surface, the side will be turned and a blow will be given in a similar way. Thus now from one side and then from another—that is by alternate flaking a tool of required size and shape is prepared. (Fig. 13).

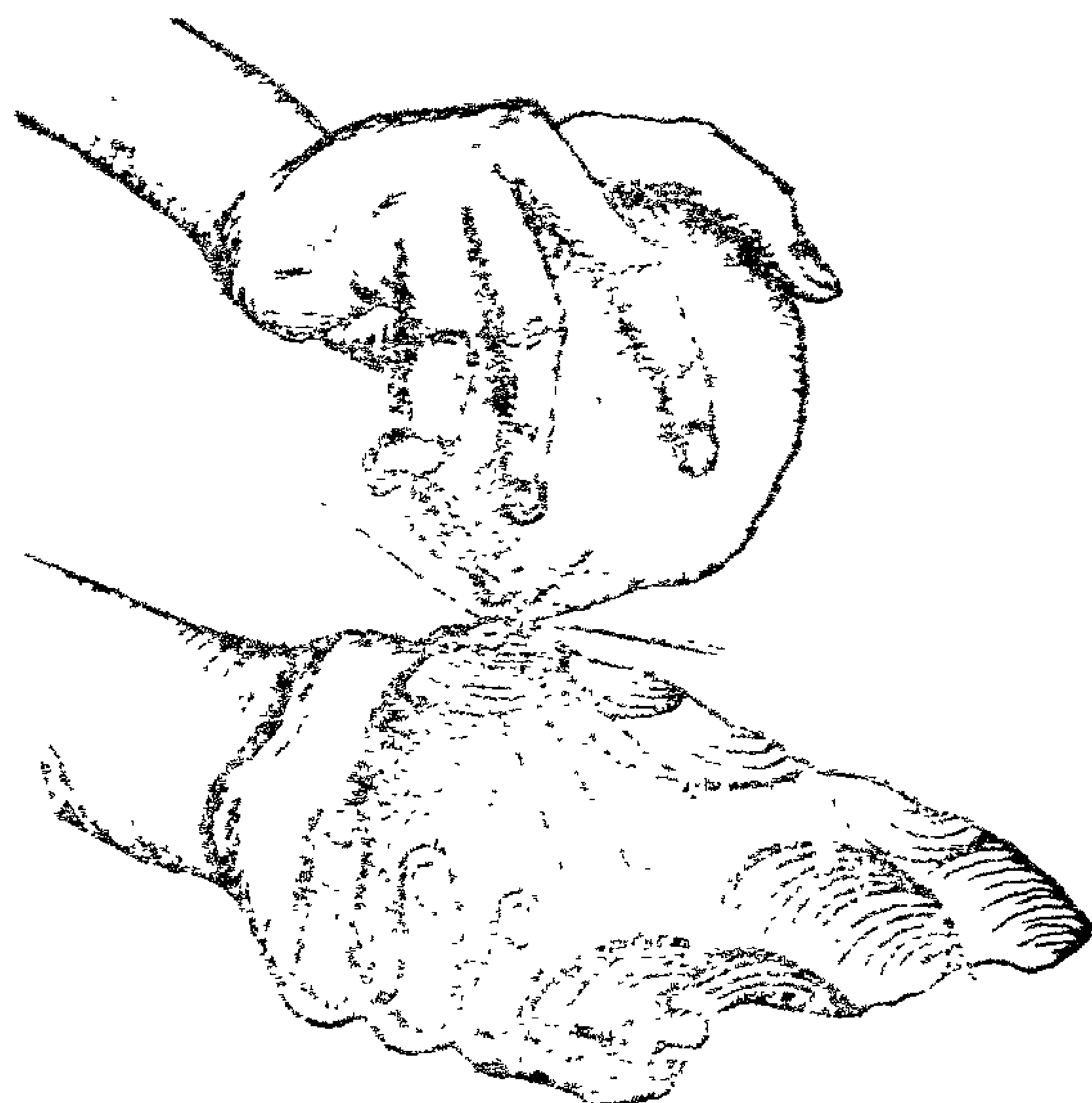


Fig. 13. Alternate flaking

1. LEAKEY in *A History of Technology*, Vol. I, p. 130 (Ed. by CHARLES SINGER and others, 1956)

Flake Culture

With the tools made on pebble or nodule and resulting in simple tools or bifacially made handaxes, a certain number of large and small flakes are always present. And therefore it is not easy to say that these flakes constitute a distinct "industry", and further a different mode of life of the man making them as to be called a "culture". However, at certain sites in England and on the Continent *only* a large number of flakes appear. Secondly, from the way they are carefully "retouched" after removal from their cores into certain shapes which must have been intended, it was thought that at these sites the man carried on his livelihood mainly with the help of such flakes (however the writer believes that some heavy tools must have been necessary, though these might not be like the handaxes and cleavers).

In fact, Hazzledine WARREN has shown that the industry does not exclusively consist of flakes, but does include chopping tools, which are alternately worked on one end to a zigzag edge. However, the Clactonian Industry has been regarded as a distinct entity. So far it does not occur outside North-Western Europe.

Such flakes were for the first time noticed at Clacton-on-sea a small town in the county of Essex, England.

Clactonian Technique

From the study of the traces of flaking called "fracture scars" left on the flake and the core or the nodule, the method by which these or any other flakes were made can be reconstructed. In the Clactonian technique a nodule is selected which has fairly regular surfaces intersecting or meeting in a ridge. Such a ridge is normally found in a flat river pebble. It is usually dull and may be rounded, but in the case of a pebble or nodule broken naturally, there might be a sharp edge.

Having selected such a nodule, a blow is given (with another stone) near the edge of one of the flat-ended (plain) surfaces. If this blow is well directed and of suitable strength, quite a good flake will be detached.

If we now examine this flake, it will be found that it has a tiny, circular, raised projection on the undersurface, near the place (called "striking platform") where the blow was given. In books on prehistory, this is often called "bulb of percussion." Depending upon the nature of the blow and also the rock, this bulb is

conical or diffused and surrounded by a series of ripple-like rings. (Fig. 14). The bulb and the ripple marks are the result of the mecha-

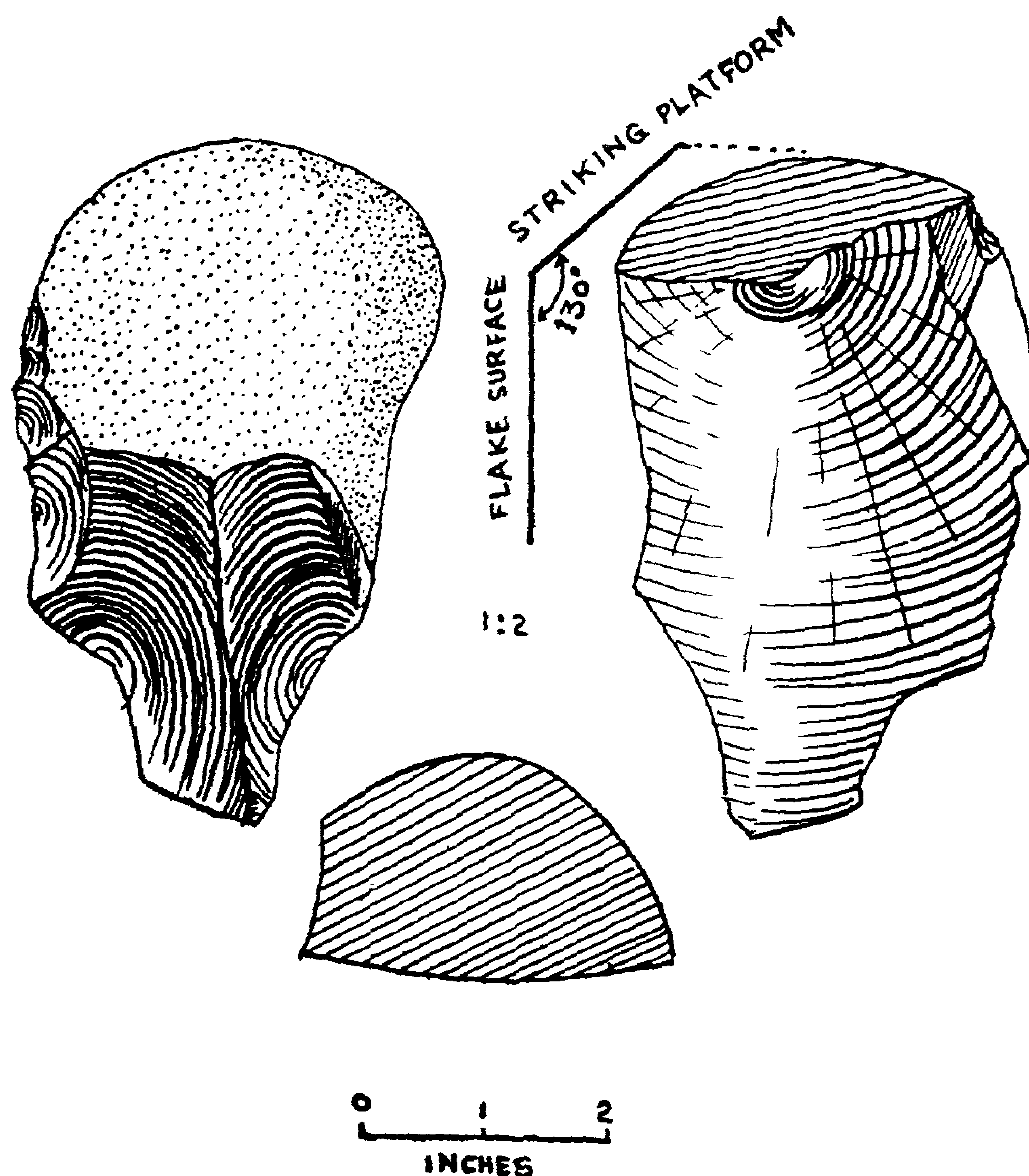


Fig. 14. *Right :* Bulb of percussion and ripple-like rings.
Left : Pebble surface on the butt end with some flakes removed from the point and sides

nism of force penetration. The force exerted by a blow does not travel in the stone in a straight direction. but in ever-widening circles similar to the phenomenon of ever-widening circles caused by the throwing of a pebble in a still pond. If the blow is given in the centre of a pebble and is sufficiently strong, then a full nipple shaped cone will result. However, since for detaching the flake the blow is generally given at a corner or side of the pebble, only a part or half the cone is formed. This is because only a part of the force penetrates the pebble and the remaining goes into the air. For this

reason the "bulb of percussion" is also known as "semi-cone of percussion".

After the removal of the first flake, a hollow surface will naturally occur on the core. This is always concave; hence it is described as "conchoidal flake scar" or "negative bulb of percussion." Observation and experiment have shown that such scars and flakes with prominent bulb of percussion occur *mostly*[1] when a flake is intentionally removed. So both these features are extremely useful in distinguishing a natural flake or core from an artificial flake (or core)—known as an "artifact".

This concave flake scar serves also another purpose. It acts as a platform for removing the next series of flakes alternately from each margin. In this way, if the material is suitable, a biconical core with circular outline and a sharp, zigzag or wavy edge will ultimately result.

It is also seen that the angle between the plain undersurface and the platform is generally more than 90°, roughly 120° as mentioned above, whereas the "platform" (*the place where the blow was given*) is quite plain. Both these—a huge core and a large flake—from our collection at Maheshwar on the Narbada have been here illustrated. (Fig. 43-44).

Such cores might have been and in fact were used as choppers or scrapers, whereas those cores which could not be fully flaked and had to be abandoned would look like round balls.

So far such globular cores were reported from a site called Ain Hanech, near St. Arnaud in Algeria. Their discoverer, Professor ARAMBOURG, not only regarded them as tools, but also as coming from pre-Pleistocene—that is Pliocene deposits. Thus these round, ball-like cores would rank with others as the earliest tools. This claim is not universally accepted.

What is important from our point of view is that such cores have been found at Nevasa and the sites in the Godavari basin, in association with handaxes and cleavers. These not only look like cores, but the flat unworked surface at one side and a pointed conical end on the other with a jagged edge all round in the centre, seems to suggest their use as hammerstones.

1. However, Robert Bruce FOOTE has noted and the writer has also observed flakes with fine bulb of percussion caused by pressure while walking, or when cattle tread over pebbles. Similar observation has also been made by BREUIL. See Desmond CLARK, *op. cit.*

Though we may call this method by a particular name, it will be clear by a comparison with the "Stone Hammer" technique that it is not fundamentally different from the latter. In fact this method is likely to occur to any fresh maker of tools (or breaker of pebbles or rocks) anywhere in the world. Hence it is that the early primitive flakes either from England or India or Africa show some or all the characteristics described above. When the resemblance is very close, writers very often describe the core or the flake or the method as "Clactonian", *but thereby it is not meant that the flake from India, for instance, is indeed as old as the true Clactonian flake from England. No contemporaneity in time is implied by such usage.*

Step or Controlled Technique

As the name signifies, while trying to flake a pebble or a block of stone with another stone (i.e. hammer), the maker has to control the force of his stroke. This is done when he holds the pebble to be flaked in his left hand (or right hand as the case may be) and hits slowly with his hammer on the periphery of the pebble. The latter is held almost against one's body and thus naturally the stroke has to be controlled so as not to hurt oneself. Such a stroke against the heart or thickness of the pebble does not go very deep and usually leaves a "Step".[1] LEAKEY[2] (who has experimented) says that small hammerstones were used for this and other kinds of secondary work. And even the anvil technique with some modifications such as a change of the angle could be used for the purpose.

Cylinder Hammer or Wood—or Bone Hammer Technique

However, from St. Acheul in France tools were discovered which showed an unusually smooth and even surface unlike the earlier handaxes from Abbeville. Experiments by Dr. LEAKEY and others indicated that such a surface could be obtained by using a hard wood, bone or weathered stone and striking in such a manner that (i) the force of the blow is directed at the actual edge of the stone struck and *not at a little distance in from the edge,* and (ii) although one particular point of the hammer hits the stone first, the fact that the hammer is comparatively soft means that

1. This is how one trims a pencil or dresses vegetables and may be profitably compared with the attempt of a beginner who wields a knife for the first time and generally removes large, uneven flakes by cutting away from his body.

2. LEAKEY in *A History of Technology*, p. 136.

almost instantaneously force is applied also from other points along the rounded surface of the hammer. (Fig. 15). Thus instead of the

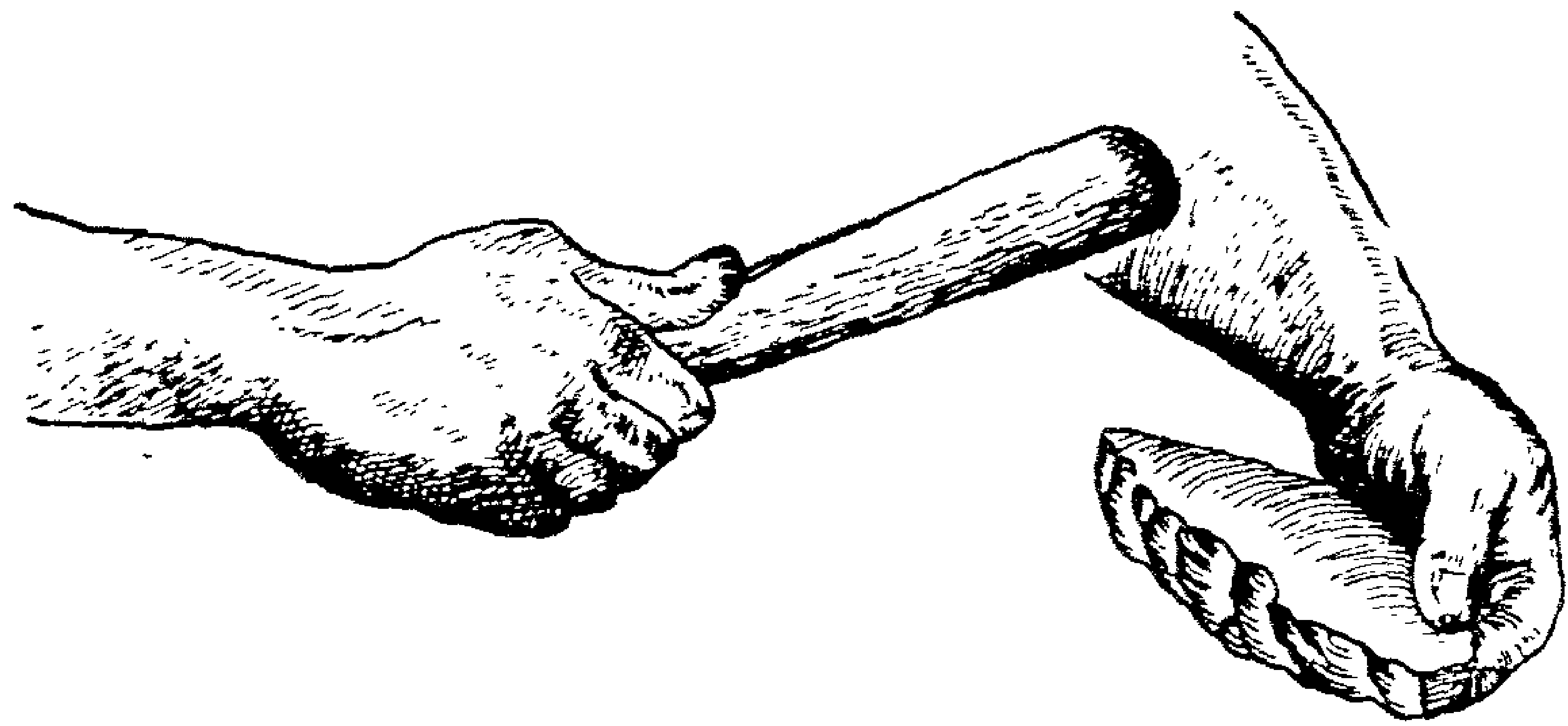


Fig. 15. Cylinder Hammer Technique

crack spreading from one point and giving rise to a marked bulb of percussion, it spreads from a larger area of contact through a flattened area. This results in a flake which is very flat. A series, or rather the inter-section of a series of these flat flakes produces a nearly straight cutting edge. It must be emphasised that the older stone hammer technique was still used for making rough tools as well as for the initial preparation of finer tools. The cylinder hammer technique was used for the finishing process!

LEAKEY[1] further demonstrated that a cylindrical hammer—whether it be of stone or wood or bone—would also yield such a fine result. The difference, it seems, between an ordinary hammer, pointed or otherwise, and a cylindrical hammer is that in the latter the undersurface—the tangent of the cylinder—comes into contact with the stone to be struck and not the narrow edge of the pointed tool. The resultant flakes are generally thin and flat with a diffused (or flatter than in any ordinary flake) bulb on the underside. Further, the tools—handaxes and cleavers—show a symmetrical outline.

It is obvious that such tools bespeak of mental development, a sense of planning and design, and the use (discovery) of appropriate means for achieving it. After the type-site of St. Acheul, the technique is called Acheulian, and applied wherever—Western Europe, England, Africa, Palestine, Iraq, Iran, India—such tools are found. In India, however, such tools occur together with the Abbevillian and hence do not necessarily show any chronological development.

1. LEAKEY in *A History of Technology*, p. 131.

Levallois Technique

A more advanced, artistic and skilful method of preparing flakes and cores seems to have been discovered a little later. It was first noticed in flakes found from Levallois Perret, a suburb of Paris. Hence the technique has been often described as 'Levalloisian'.[1]

In this method instead of straightaway hitting one flattish pebble or core with another pebble,

Firstly, (it appears from the study of flakes and cores and by experiments) the core was carefully prepared[2] by initially roughly trimming the sides and then from the uppersurface the cortex was removed in such a manner that the flake scars usually meet in the centre. (Fig. 16). In this way all irregularities, uneven surfaces—were removed, and the core assumed more or less, *not smooth,* but rounded or semi-rounded appearance.

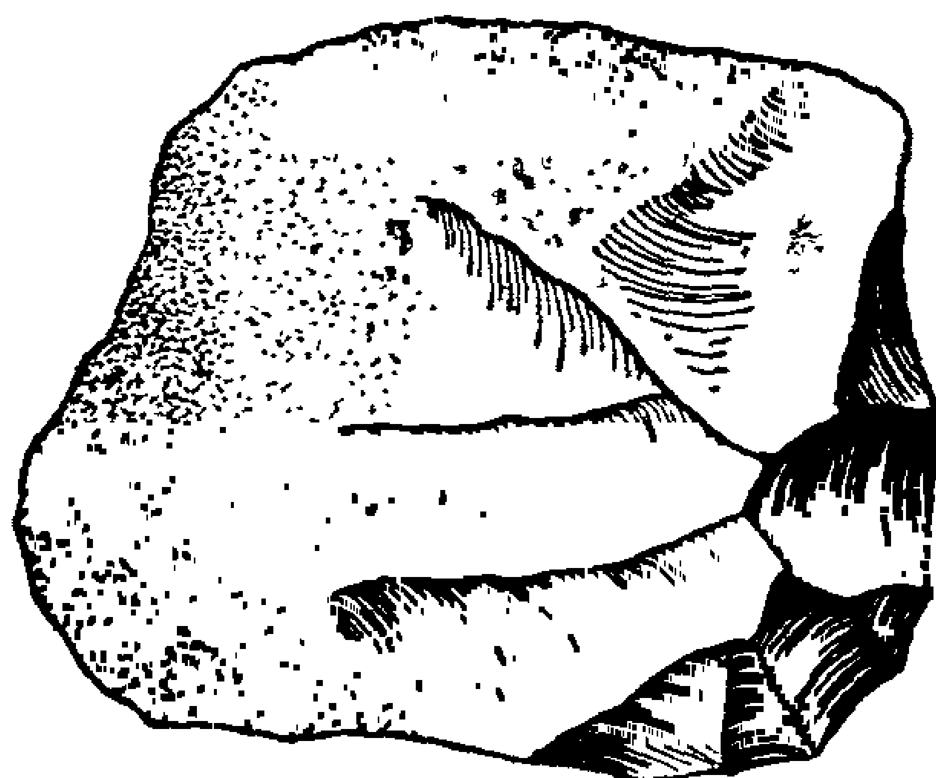


Fig. 16. Preparation of Levallois core

Secondly, a flattish place called "striking platform" was prepared, by removing very small flakes, on the core (by the help of a smaller tool like a punch or chisel) along the margin, where the two surfaces of the core intersect. This may be anywhere, but was preferably at the shorter end or in the middle of the

1. BORDES, Francois, "Principes d'une Methode d'etude des techniques de debitage et de la typologie du Palaeolithique ancien et moyen" in *L'anthropologie*, Vol. 54, 1950, pp. 21-34.

2. This may be explained by a very simple illustration. Some persons—generally beginners—mend a pencil by flaking hurriedly with the result that irregular, thick chips come off, leaving depressions over the mended portion. Others would make a thin incision around the portion to be mended and then flake carefully, mostly by pressure. This gives a smooth regular surface. If the chips from both these methods are compared as well as the flaked surface, *some idea* can be had of the Levallois and Clactonian methods.

longer side and perpendicular to the longer or shorter axis. (Figs. 17-18).

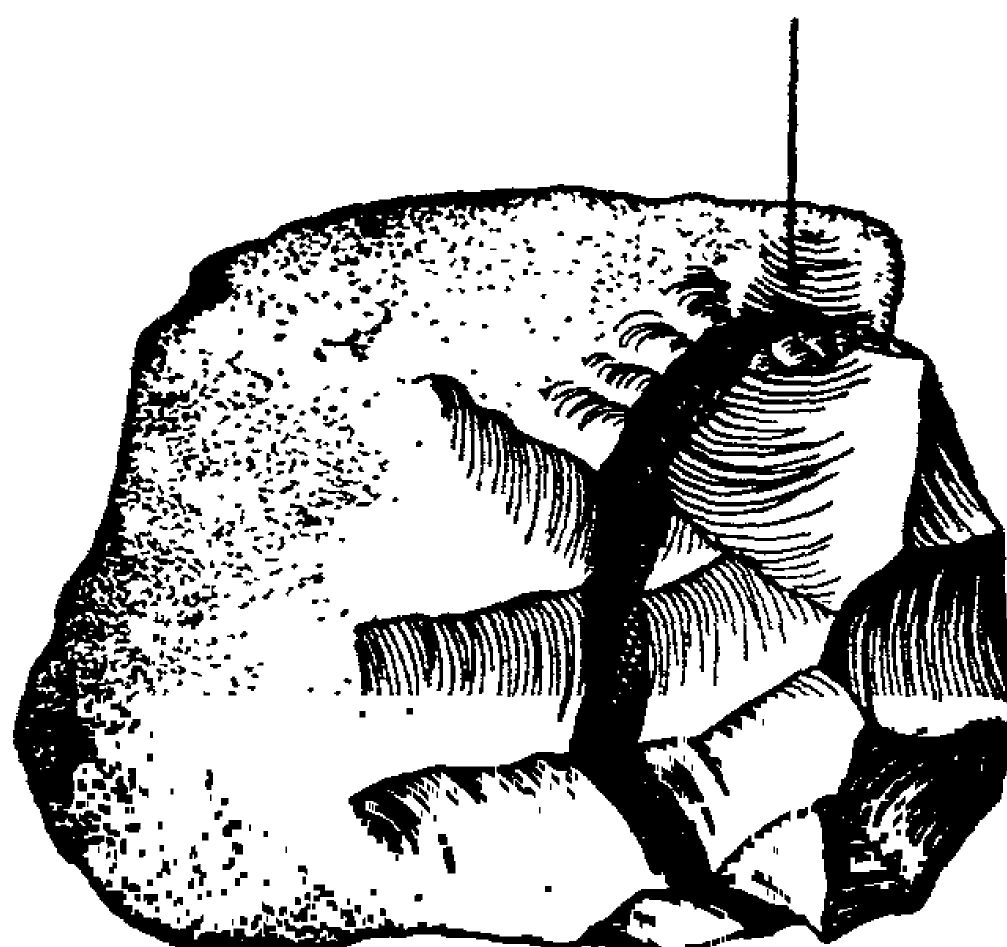


Fig. 17. Levalloisian core with the flake (replaced) to show where the blow was struck 1 : 2

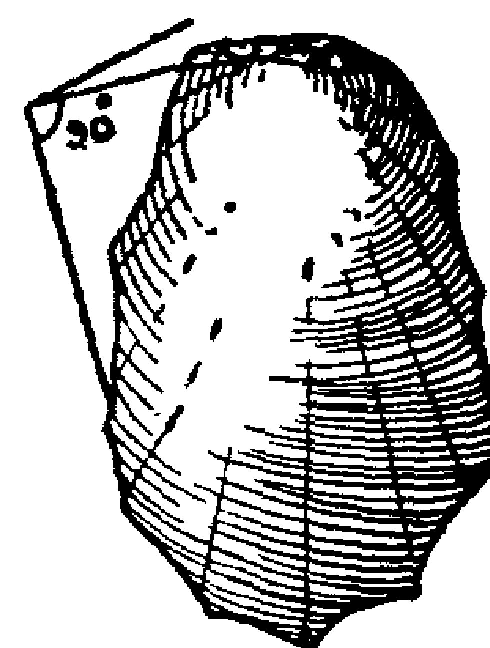


Fig. 18. Levallois flake showing the prepared platform and 90° angle

Thirdly, the blow was then, given by a (possibly sharp or narrow pointed) tool either directly or through an intermediary tool known as "punch" on this prepared surface (platform) by holding or supporting the core with the left hand (or right hand as the case may be) in such a way that the blow was almost at right angles to the platform or the axis of the tool. (Figs. 17-18).

The result was that a comparatively thin flake, roughly triangular or oval in outline, came out (Fig. 18). It had a clean undersurface, and a part of the prepared platform forming an angle of about 80°-90° with the undersurface. The uppersurface should ordinarily[1] bear shallow triangular centrally directed flake scars indicating previous preparation of the core. (Figs. 17-18). It required little or no subsequent retouch because its edges were already sharp due to previous preparation.

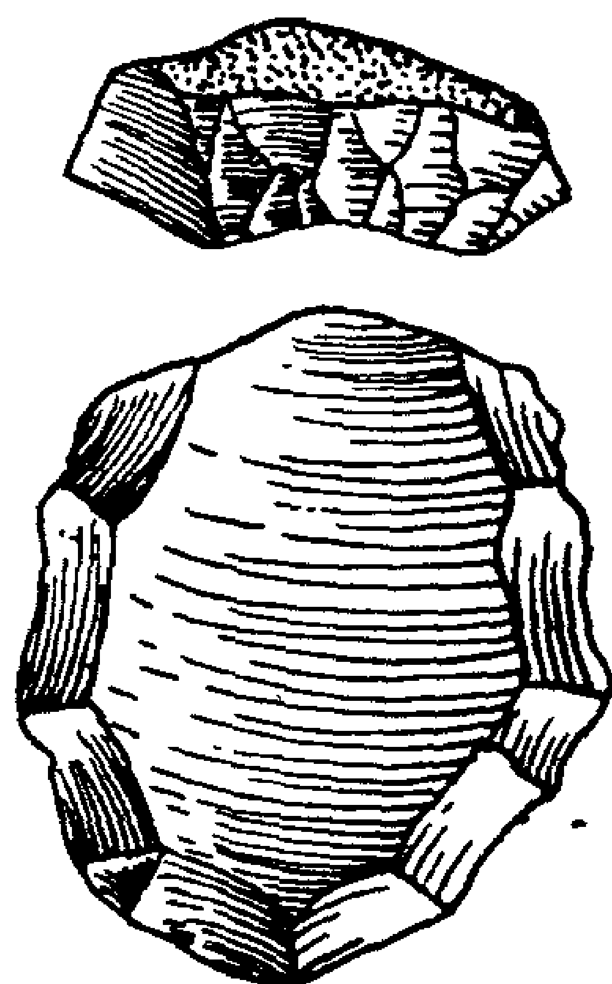


Fig. 19. "Tortoise" or Levalloisian core after removal of the flake, showing a part of the platform and fine conchoidal flake scar 1 : 2

The core shows a shallow conchoidal flake scar, sometimes a little bit of the prepared platform, flaked prior to the removal of the main flake. (Fig. 19). Particularly striking is the appearance of the core. Since this is generally oval, it is called a "tortoise core", implying thereby that "the rounded undersurface of the core resembles

1. A "classical" Levallois flake from many of the French sites does have centrally directed flake scars on its upper surface, but this feature is often absent in Africa and India. In the latter only "prepared platform" is seen. Hence the preference for this expression over the term "Levallois" in describing the technique outside Western Europe and Northern Africa.

the upper shell (carapace) of a tortoise, while the fine conchoidal flake scar would look like its belly or technically 'ventral' underside."[1] According to another view,[2] such a core having its surface marked by centrally directed flakes is said to resemble the back of a tortoise, the flakes resembling its plate.

It was formerly believed that in Western Europe at least, Levallois flakes were not associated with handaxes. Hence Levalloisian was regarded as a distinct flake culture. However, recent studies by Francois BORDES[3] indicate that there is no sharp stratigraphical difference between the flake and core culture, and that the Levallois technique appears in the middle of the Acheulian stage in the development of the handaxe.

In South Africa and India, however, such finely made flakes occurred together with handaxes and it was indeed difficult to separate the two. The late van Riet LOWE long ago wrote that the flakes formed an integral part of the handaxe culture in South Africa.

In India too, the position is not much different, though in the Panjab, De TERRA and PATERSON noticed that flakes with Levalloisian character appear only in the Late Soan A, during the Third Glacial times.

In the rest of India, the picture is not as yet clear. No unambiguous stratigraphical evidence is available to divide the various handaxe groups. It would, however, appear that the true Levalloisian flakes are later than the early Abbevillian type of handaxes, but are related with the finer Acheulian handaxes.

In France too, according to a very recent observation by BORDES[4], "the Levallois technique of flaking appears *as part of the Acheulian culture,* as almost everywhere in the world". This is believed to be in pre-Riss times, but later the story is not yet clear. At some sites in France, for instance at Saint Acheul, the Levalloisian technique is absent. So also the typology of the handaxe is not always the same in contemporary levels. Hence BORDES concludes "several factors seem to interplay, among them the conservativeness of the human mind and the quality of the available flint".

1. McBURNEY, C.B.M., *The Stone Age of Northern Africa,* p. 133.
2. Movius in *Anthropology Today,* p. 166.
3. *Ibid.,* and see below for full reference.
4. F. BORDES, "Some observations on the Pleistocene Succession in the Somme Valley", *Proceedings of the Prehistoric Society for 1956* New Series, Vol. XXII (1957), p. 5.

The difference between the Clactonian and Levalloisian methods of obtaining flakes does not lie merely in the artistry, that is, in getting thick, coarse or fine, regular flakes. The Levalloisian technique is on the whole more economical though lengthy (or time-taking). In the Clactonian the size of the flake could not be guaranteed or pre-determined. The blow was given anywhere on the margin of a pebble, nodule or block of stone in a haphazard manner. Thus a small or large, thin or thick flake came out. Such a flake may not be found useful. Secondly, the subsequent flaking of the core cannot be planned in advance. Thus there is eventual loss of the material, and even in case of the flakes already removed, the usable edge may not be of sufficient size or sharpness.

In the Levalloisian, on the other hand, though each time only one flake could be obtained, and every time the core had to be prepared again, the size and the quality of flake were assured. Ultimately the man could produce more flakes from a given core.

Discoid Core or Mousterian Technique

Related to, or comparable with, the Levallois technique of flake manufacture is another method known as the "Discoid Core" or "Mousterian" technique. The latter is again from the French cave site of Le Moustier in a small village on the Vezere river in the commune of Peyzac (Dordogne) in France. A study of a large number of small flakes and cores from this site showed that while making this the man must have used either:

(i) a large flake with a flat surface on one side, or

(ii) a flat nodule or core with one side at least flat. Next, blows were struck on the flat surface either of the nodule or the flake, so that comparatively small flakes came out. These flakes would be generally round or polygonal, leaving identical flake scars on the core. By turning the core (and depending upon its size) a large number of flakes can be produced. The resultant residue or core shows a flat surface in the centre (having cortex, if a nodule was selected) having a rim made by the intersection of the sloping surfaces of the scalloped flake scars. In short, a core with a central flat surface and bevelled rim is produced. (Fig. 20).

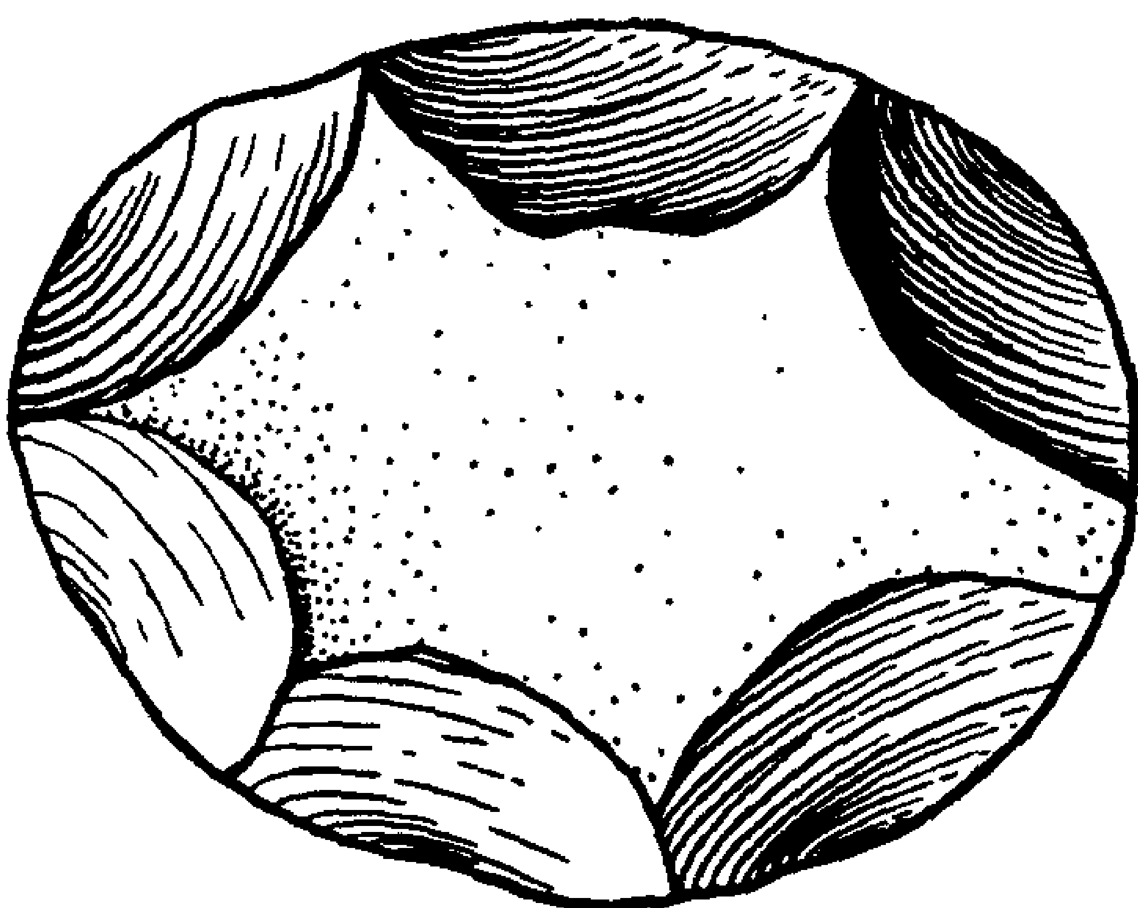


Fig. 20. Discoid or Mousterian core 3 : 4

When the tortoise cores and such discoid cores as well as the flakes from the respective cores are compared, the differences between and advantages of various techniques can be immediately seen.

In the tortoise core only *one* flake can be produced at a time. For producing another, the core has to be rejuvenated or prepared again. But in the discoid core, a large number of flakes can be had without rejuvenation.

However, whereas a tortoise core can yield large flakes, sometimes even five to seven inches in length, the discoid core can yield only small flakes—about two to four inches in size. Of course, each type of flake had its use or function in the mind of, and actual use by, the pre-historic man. The large flakes were converted into beautiful ovate handaxes everywhere, in Western Europe, Africa and India. The small flakes from discoidal cores were useful for several kinds of scrapers and points.

The flakes from tortoise cores will show on the reverse (back side) several tiny flake scars indicating the preparation of the cores, but in the core of the discoid type only a few—three or four—or *even none*.

The Mousterian culture has a distinct chronological, (stratigraphical) ethnical and even geographical significance in Europe and also to some extent in North Africa. Recently it has been discovered in Eastern Europe, Central Asia, and Iran. It is said to be confined to the upland regions of Western and Central Europe, occurring in caves which were inhabited by men of Neanderthal type, who primarily depended upon such small flakes for eking out their livelihood.[1]

Such discoid cores and flakes do occasionally turn up in the Stone Age Cultures of India. But as yet no positive stratigraphical idea of their occurrence is available and hence the further step in understanding their geographical distribution is out of question at the moment.

Chellian[2]

This name of the technique is after the site Chelles on the junction of the rivers Seine and Marne in France. It was found

1. (a) Movius, Hallam L. Jr. (1953), "Palaeolithic and Mesolithic Sites in Soviet Central Asia", *Proc. Am. Phil. Soc.* Vol. 97, No. 4, pp. 383-421.

(b) Howell, Clark, F. (1959). "Upper Pleistocene Stratigraphy and Early Man in the Levant", *Proc. Am. Phil. Soc.* Vol. 103, No. 1, pp. 1-65.

2. Also spelt Chellean.

that the handaxes found here showed deep flake scars and irregular outline with a heavy butt. (Fig. 46). This was obviously after the "Stone Hammer" or Direct Percussion Technique with a comparatively heavy hammer.

Besides this technological feature, the tools were found in a deposit which underlay that of a later period. Hence the tool from Chelles came to occupy a certain chronological significance. This was unfortunately extended to other regions outside France, wherever these features were observed. Hence when literature on prehistory in India or elsewhere contains such terms as Chellian, *it only means that the tools resemble those of the type site in form and technique but they are not necessarily so old or contemporary with them.* Such a restricted use and connotation of the term is not wrong.

Abbevillian[1]

This technical term is after the site Abbeville on the Somme in France. It is now used in preference to Chellian described above. For it is realized that Abbeville gave a better sequence of handaxe cultures than Chelles, and is stratigraphically the earliest and thus the oldest handaxe industry.

The tools, however, show the same features as at Chelles, and therefore both the terms—Chellian and Abbevillian—are now used for describing handaxes with deep flake scars and irregular outline indicating an earlier stage in the handaxe industry. (Fig. 46). Such handaxes were prepared either by striking with a stone hammer or by striking the nodule against an anvil.

Acheulian[2]

The site at Saint Acheul in the Somme Valley was the first site in France where stone tools were discovered by Boucher de PERTHES in about 1836. It was later found that handaxes from this site were much finer than those discovered at Chelles or Abbeville. Careful observation and experiments showed that such fine controlled flaking—very shallow flake scars almost skimming the surface, flat surfaces with biconvex or lenticular section and regular outline—was achieved by a light cylindrical hammer, either of wood, bone or stone. (Figs. 15 and 48). Hence the term Acheulian has now come to signify a very advanced stage in

1. Also spelt Abbevillean.
2. Also spelt Acheulean.

the development of handaxe culture, stand as it does for symmetry of form produced by a certain technique. It must be emphasized once again that ouside France its use has little chronological significance, though it is true that in India as well as in Africa handaxes do show a gradual improvement which may correspond with the Abbevillian and Acheulian. However, in India, at least, no stratigraphical evidence is yet available to understand the various stages of development.

In France, at the site of St. Acheul, very minute developmental stages have been noted by the Abbe BREUIL[1] and he has therefore subdivided the Acheulian into several sub-stages.

Middle and Late Stone Ages

In the Middle Stone Age all the above techniques singly or simultaneously seem to have been employed, and a new method called the "Blade Technique" also seems to have come into use. For blade-like flakes have been reported from several sites of this period in India as well as in Western Europe and Africa. But its definite introduction was in the Late Stone Age and it continued thereafter in the Neolithic and Chalcolithic times not only in India, but elsewhere, right upto the modern times.

Blade Technique

Every "blade" is a flake but all flakes are not blades. A "blade" by its very connotation is thin and slender as opposed to thick or broad. And this rules out a large number of flakes from inclusion in the category of blades. While this difference can be seen by anybody, the underlying causes need a careful study and observation.

In the Clactonian, Levalloisian and Mousterian methods of producing flakes it was pointed out that

(i) the cores were usually flat;

(ii) the platforms wide and faceted;

(iii) the flakes round, oval, or triangular.

But as opposed to this in blade techniques

(i) the cores are generally cylindrical and "fluted" (Figs. 25 to 31),

(ii) the flakes long, narrow, and slender,

1. *Proceedings of the Prehistoric Society for* 1939, Vol. V. p. 33ff.

(iii) the platforms of the flakes show minute facets.

Thus, first the cores are quite different in shape and size from those of the earlier periods. Secondly, the cylindrical core was not struck directly[1], but a wood or bone punch was placed against it and by pressure exerted in different ways, a thin, narrow flake was detached.

An almost identical method is still practised by the stone-workers of Cambay. A pointed metal tool is kept fixed as an anvil. The worker holds the core of agate, chalcedony etc. against it and then gives a tap with a bone hammer (usually deer horn antler) and out comes a narrow long flake. (Fig. 21).

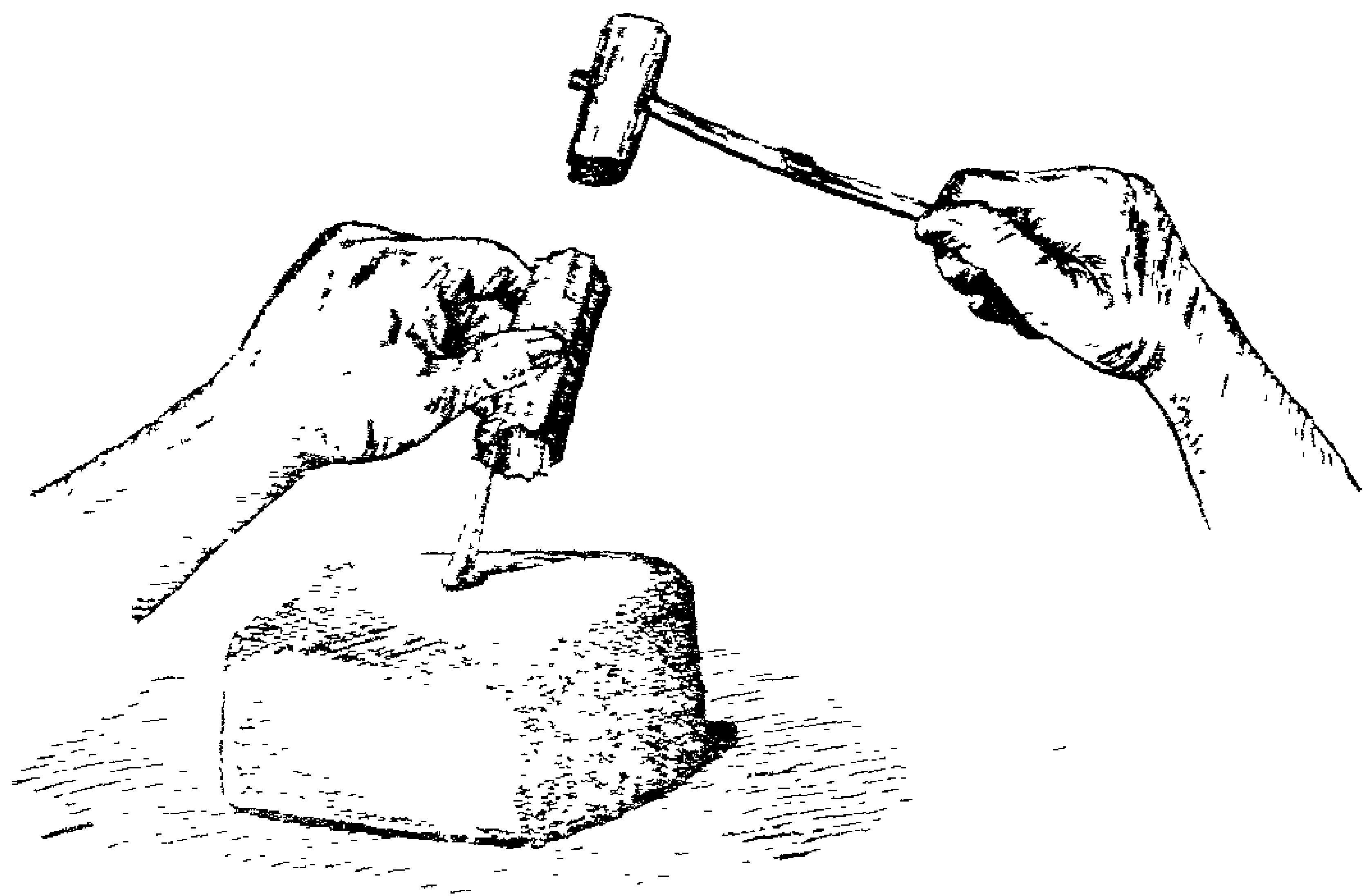


Fig. 21. Method of removing a blade flake at Cambay, Gujarat

This method of producing flakes was continued later in the Neolithic and Chalcolithic times with a few modifications. Depending upon the raw material, the core and the flake tended to become smaller. For instance, the flakes and cores of the Indus Civilization (which received its supply from Sukkur and Rohri in Sind) are generally three to five inches long, but in other Chalcolithic cultures, which used primarily chalcedony available at various indigenous centres, the cores vary from one inch to three inches and the flakes are consequently smaller, narrower and thinner. They are, therefore, often called "ribbon flakes".

1. Though from certain accounts of the methods of blade-production by American Indians and the one given by LEAKEY, it appears that blade-like flakes could be produced by direct percussion. For details see below.

The technique of removing such delicate flakes was as under.

According to the nature of the raw material and the needs (of man) the blades are long or short. But the stone used had to be fine-grained. In ancient Mexico, men preferred obsidian, a volcanic glass; in Western Europe, Palestine, Sind, Western Rajputana, and Maski (Raichur District), flint, but elsewhere jasper, chert or chalcedony. However, it appears from the accounts of travellers who have observed the preparation of blades by the ancient Mexicans, Peruvians, the primitive Australians and the actual experiments[1] along with the study of the cores and blades from several parts of the world that

(i) Pressure Technique (Figs. 23-24),

(ii) Pressure and indirect or direct Percussion Technique (Fig. 21)

(iii) or only Percussion Technique was practised in the production of long or short blades.

Pressure Technique

Whatever method was followed the core had to be first prepared. The core was tabular (if removed from a quarry or mine) or cylindrical (if natural nodule from a river bed). If this was smooth (as in the case of obsidian) it was roughened either by

(i) other semi-precious stones of greater hardness

(ii) or by other abrasives (sand etc.)

The purpose of roughening was to enable the worker to prevent the punch on the core, when it was struck or pressed, from slipping.

Now a further step in the preparation of the core was also taken. Small platforms were made along the edge of the core. This platform was simple or multiple and is called "faceted". In some cases, for instance, in France during the Neolithic and in India during the Chalcolithic times,[1] the core was further prepared by making a ridge on it by alternate flaking. This is done by removing a series of flakes along the longitudinal axis and at right angles to its face along one edge. Another series of flakes is removed from the opposite side, with the negative scars of the earlier flakes serving as platform. The result is that the earlier flake scars are truncated and a ridge with a zigzag edge is prepared. (Fig. 22).

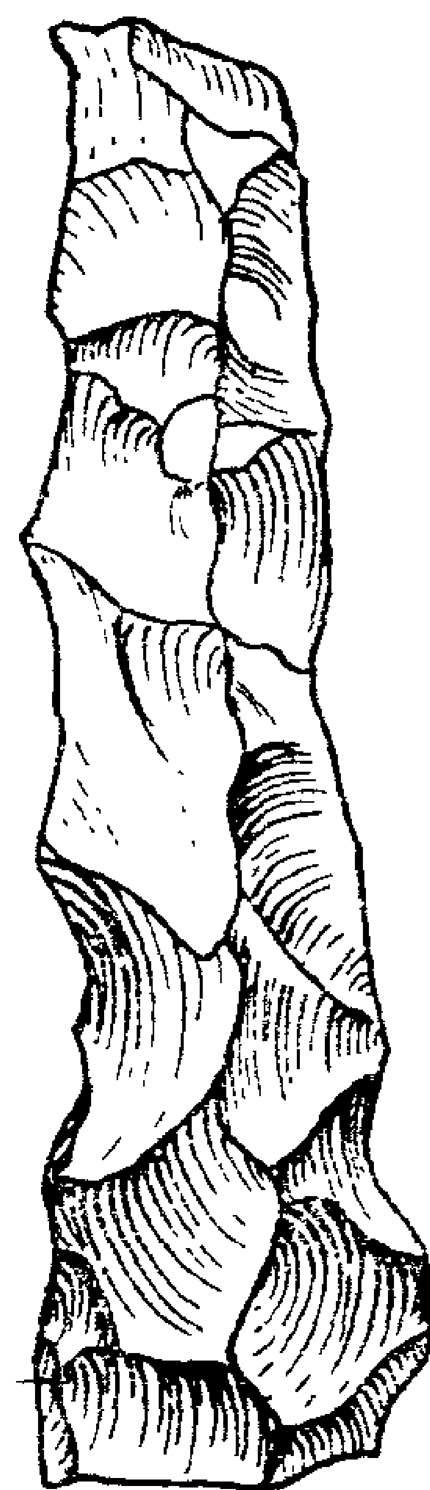


Fig. 22. Flake with Crested Ridge 1:1

1. See SUBBARAO (who has discussed the whole question of the origin and distribution) in SANKALIA, H. D. and others, *The Excavations at Maheshwar and Navdatoli,* 1952-53, Poona-Baroda, 1958, pp. 45-65.

It was first pointed out by Sir John EVANS that it was this ridge which regulated the course of the fissures by which the dake was dislodged from the core. Such "a removal of two series of flakes from either side of a predetermined line along the length of the core, creates a series of weaknesses parallel to the ridge". This facilitates the detachment of a long flake. Hence this ridge is also called "crested guiding ridge".

The crested ridge would also serve as a keel which could be inserted in a groove or a slot to keep the core in position while flaking.

"The cores were then partly embedded in hard earth" or "secured between two strips of wood like the jaws of a vice, bound together by cords or thongs of raw hide".

Next the worker would take a shaft or stick about 2 to 3 inches in thickness, and 2½ to 4 feet in length. This was provided on the lower end with a pointed bone or horn—the tooth or tusk of the walrus was preferred—(by inserting and kept in position by tying with raw hide or sinews). On the other end, that is on the top, there was a cross piece against which the chest of the worker rested. Whether the man was sitting or standing, he would also hold the core between his feet. (Figs. 23-24)

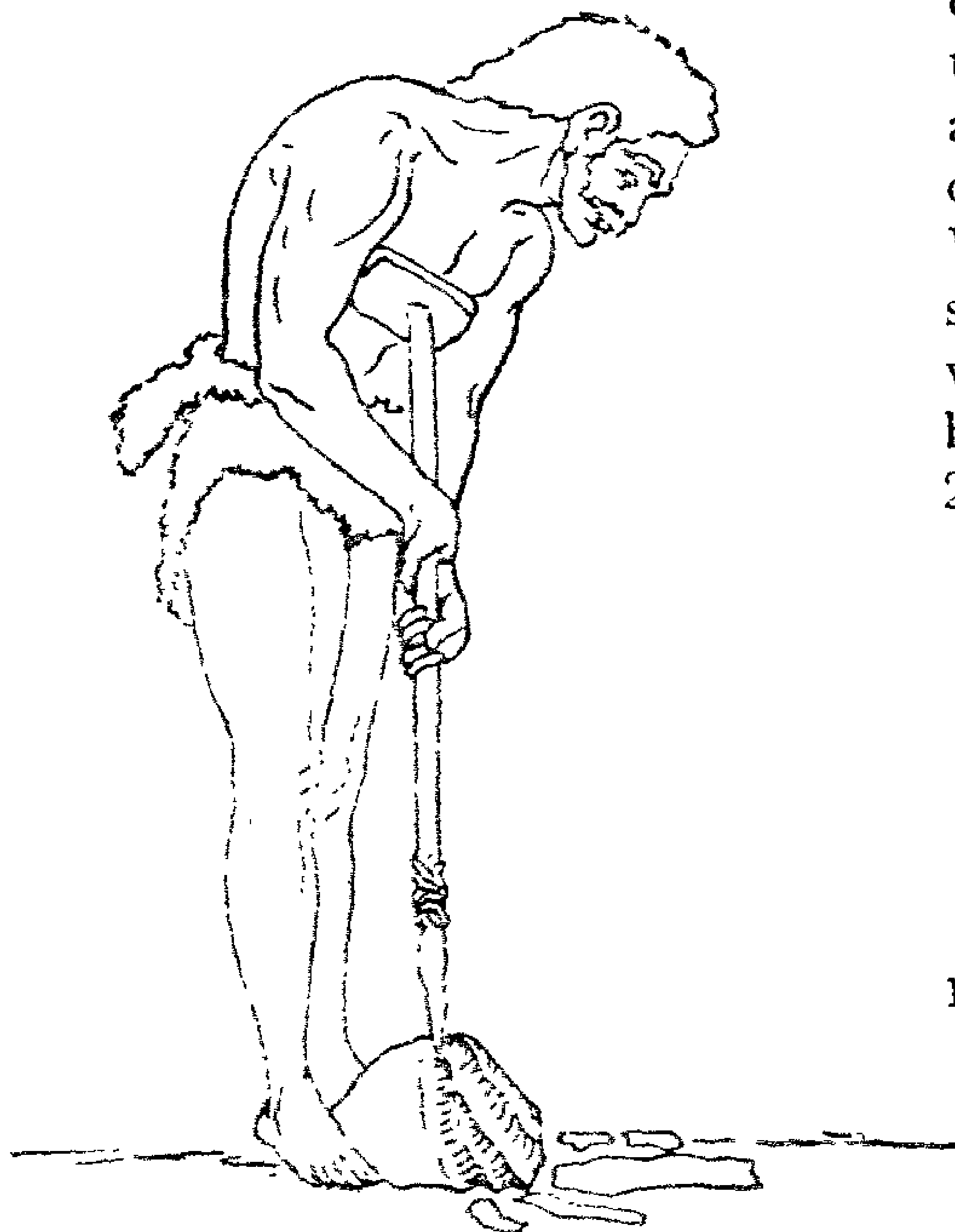


Fig. 23. Blade Production by Pressure Technique

When everything was ready, the worker would hold the staff with both his hands, rest his chest against the cross staff and apply impulsive pressure and a long flake—10 to 12 inches in length—came off.



Fig. 24. Blade Production by Pressure Technique

An interesting account of the method by which an American Indian of California produced flakes and finished them into arrow-cr spear-heads by pressure flaking only 50 years ago has been described by Theodora KROEBER in her life of *Ishi the Yahi.* The various steps in this method are briefly analysed below for its proper understanding.

i. First a large mass of obsidian of the size of a small loaf of bread is taken for obtaining a suitable flake or flakes.

ii. This mass is then directly struck with a hammerstone. This is said to be quite dangerous, as flakes of obsidian, which is a natural glass, fly around.

iii. *Alternatively,* a blunt-ended bone tool was used. It was held against the man, which when struck with the hammerstone trimmed off a large piece from the loaf-like mass without shattering the whole.

iv. After having obtained a suitable flake by free-flaking or stone hammer technique or pressure technique, further work on it began.

v. The flake was 2 to 4 ins. long, 1 to $1\frac{1}{2}$ ins. wide, and $\frac{1}{4}$ in. thick.

vi. This flake was kept vertically in position by knapper's fingers of the left hand.

vii. Flaking then began with a foot-long wooden handle, its pointed end tipped with a piece of deer antler, which was neither too sharp nor too blunt.

viii. The other end or butt of the handle was held against the ribs of the flaker, with the help of his elbow to give steadiness and act as a fulcrum.

ix. The right hand of the flaker was kept near the pointed end of the flake, while the left hand, which was protected with a double piece of buck-skin held the obsidian vertically in position (as mentioned in vi above).

x. "Pressure" was then applied, first upon the lower edge of the flake. It was applied evenly and with increasing force, downward and outward, in a scarcely perceptible motion (of the body).

xi. This removed minute fragments, semi-lunal in shape, thinning to a fine edge and varying in size from $\frac{1}{16}$ to $\frac{1}{2}$ in. in diameter.

xii. In this way flake after flake was removed, pressure being applied at adjacent points and turning the piece from side to side, establishing the outline of the artifact.

Thus *at first* large flakes and later smaller and smaller flakes came out.

xiii. In this way the opposite faces were alternately worked, attention being kept on the symmetry of form, and advantage being taken of the natural shape, whenever possible, and even

xiv. the flaker (that is the bone-tipped wooden handle) was changed, finer being selected for the stem and notching (in case of tanged specimens).

The preparation of a complete tool or weapon took about 30 minutes. It was indeed an exacting task, and is said to be best accomplished

with no change in position of the worker and above all with regular rhythm.

No wonder, a work which requires few specialized tools, and no force or strength, but simply patience, skill and art, was limited to small groups of peoples and regions and has not left us a large mass of finished products.

Blades by Percussion

In this method after a rough surface is made on the core, a small platform is prepared at one end. Against this is placed a short wood punch and a tap is given by a mallet.

It is in this way that two Frenchmen, A. CABROL and L. COUTIER,[1] produced long obsidian blades.

TYLOR[2] had noted a similar practice in Peru. Here a bone wedge was placed across the platform and light blows were given repeatedly. BARNES[3] tried this method on glass and successfully got narrow blades 12 inches in length.

LEAKEY[4] has described this method as follows: The nodule of flint, obsidian or any fine-grained material, has to be carefully prepared. Such a preparation is called "quartering". The aim or purpose of this is to have a suitable flat striking platform facing obliquely upwards. "Light tapping blows with a small hammerstone are then struck along the edge, always just above the point where the block rests on the knee. As each blow is struck, the block is simultaneously tilted backwards, altering the point of pressure against the knee, so that an effect of peeling is produced. The blows must be struck at an angle of about 45° to the surface of the striking platform, that is to say, about 135° to the direction in which the flake will be removed. After each flake has been struck, the block is slightly rotated about its own axis (keeping the striking platform always facing the same way) so that successive flakes can be removed round the edge of the core. Thus irregularities on the block are removed and since all the flakes are removed in the same direction, a fluted appearance results, due to the parallel negative flake-scars".

1. BARNES, *op. cit.*, p. 101, citing *Bulletin de la Prehistorie Francaise*, 1932.
2. EVANS, *op. cit.*, p. 24.
3. *Op. cit.*, p. 104.
4. LEAKEY in *A History of Technology*, pp. 136-38.

The entire circumference of the core is thus prepared and made ready for the removal of the blade-flakes. To achieve this, it is held as for the preliminary trimming. Each blow is now, however, struck above an intersection of two earlier negative flake scars, so that the ridge formed by their intersection will form a more or less central keel on the flake knocked off. As a variant, the blow may be struck so as to detach a wider blade flake with two parallel keels on its upper face.

It has been shown that[1] the above methods were used in producing blades in Western Europe since Acheulian times, and became the chief feature of the Upper Palaeolithic period. And it is this technique which was continued with some improvements during the Mesolithic, Neolithic and Chalcolithic times for producing short blades.

The chief distinguishing feature is that the cores are now small. They vary from $2\frac{1}{2}$ inches to about $\frac{1}{2}$ inch in length. Usually these are of three types: (a) Pointed or Conical (Fig. 25); (b) Flat-based (Fig. 27); (c) Chisel-or Oblique-ended (Fig. 26).

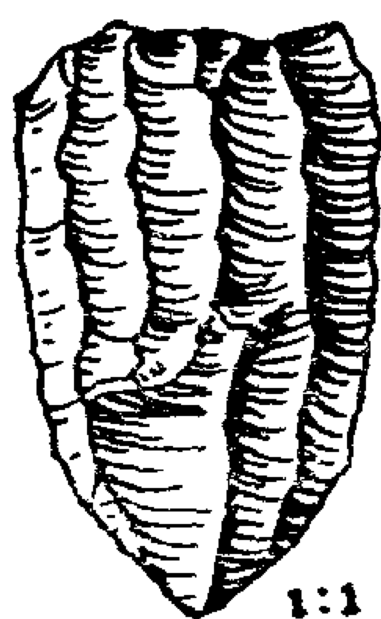


Fig. 25. Pointed core

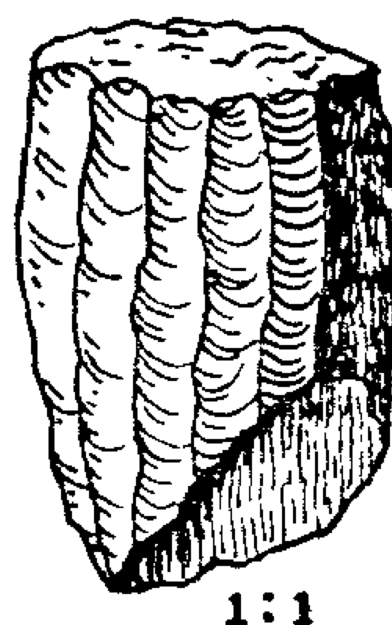


Fig. 26. Chisel or oblique-ended core

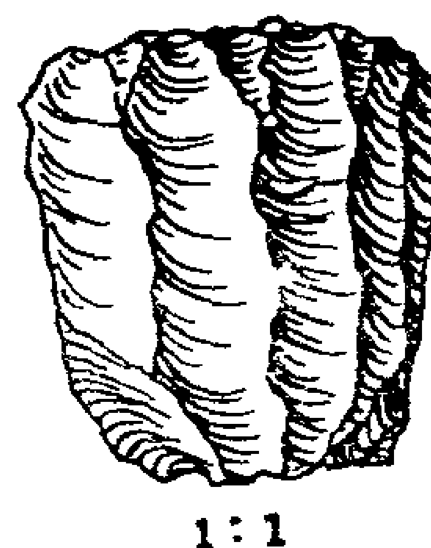


Fig. 27. Flat-based core

The flake-scars are very regular and parallel on the chisel-ended and flat-based cores, but convergent on the pointed cores. In the former case the cores look "faceted" or fluted.

The length of the flakes will generally remain constant in the flat-based core, but in the other types of cores it will gradually decrease as flaking proceeds.

In brief the following process was adopted for producing small or long blades:

1. Selection of a core—cylindrical or quadrilateral,
2. Roughening of the surfaces, if they were very smooth,

1. Barnes, *op. cit.*, pp. 104 and 109 and Fig. 4.

3. Preparation of the platform, also called "faceting" on the core,
4. Preparation of the ridge (Figs. 22 and 28-29) on the core for the guidance of flaking and/or for enabling the core to rest securely on the anvil or ground,

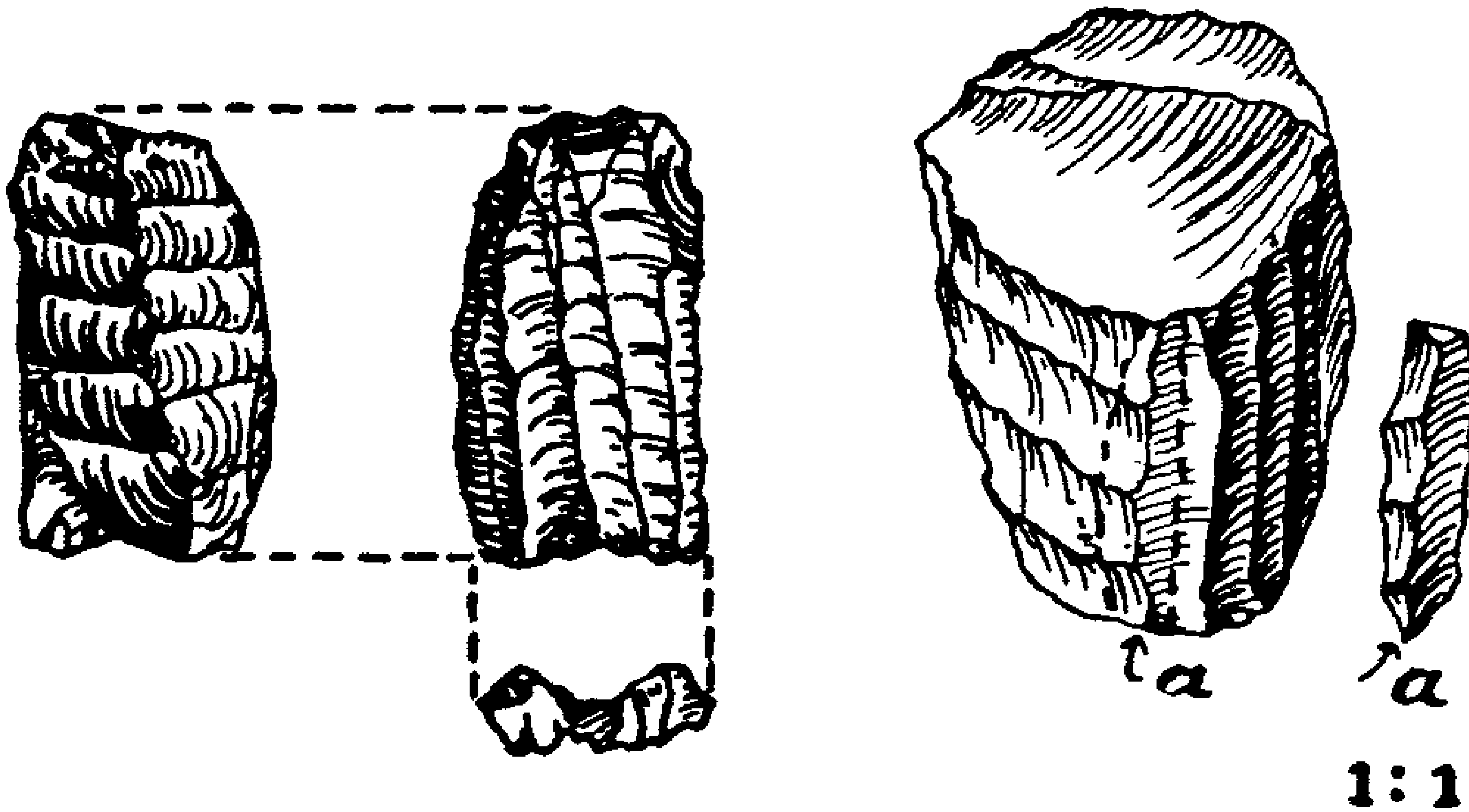


Fig. 28. Core showing cross-flaking and a crested ridge 1:1

Fig. 29. Core with parallel and cross-flaking with a detached flake

5. Removing from the core the spurs capping the ridges of the flake-scars abutting on the platform. This can be done easily on the core, but it is difficult and risky when the flake is already removed.
6. Flaking either by (i) pressure or (ii) percussion with a light hammer with the help of a punch.

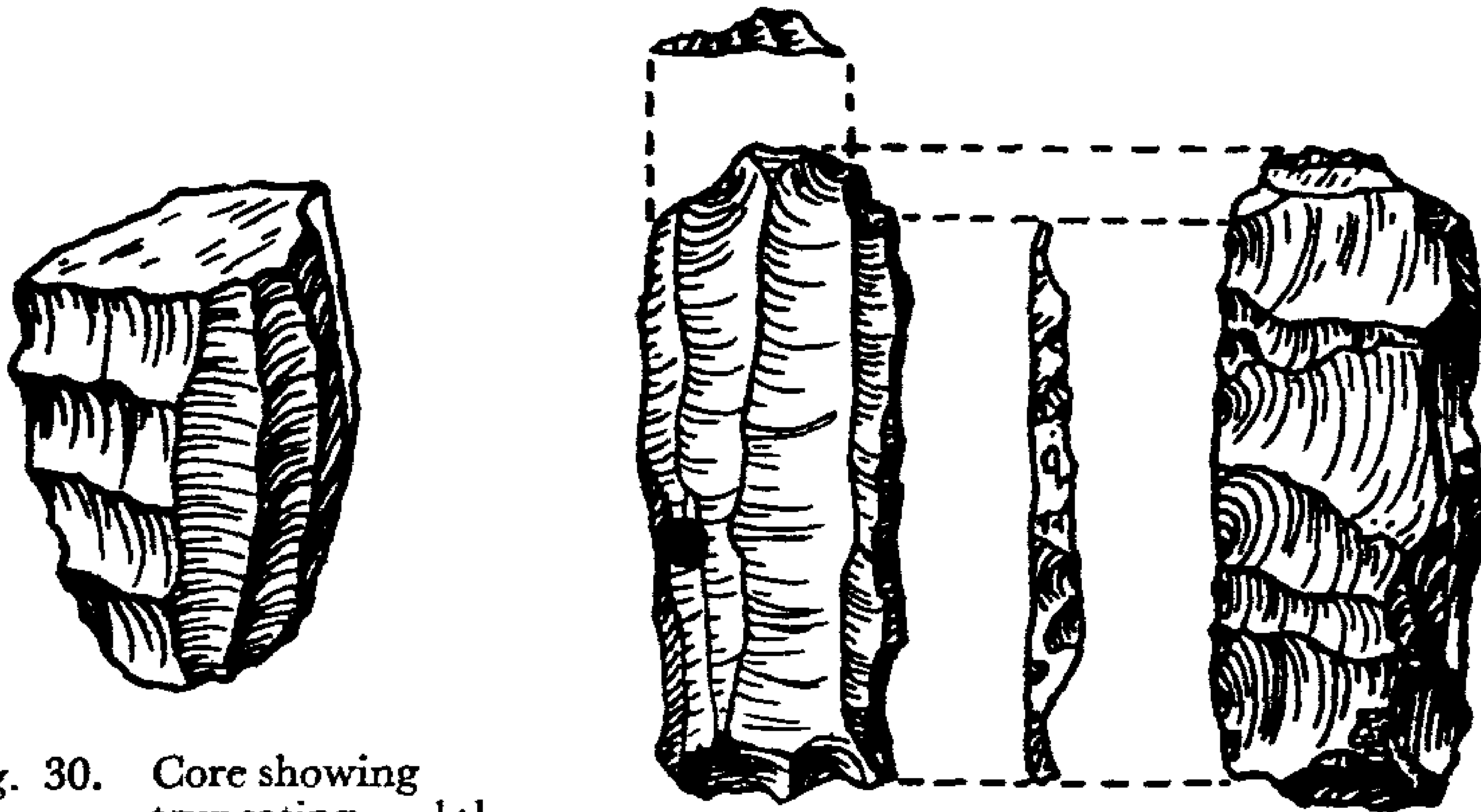


Fig. 30. Core showing truncating 1:1

Fig. 31. Core showing ripple-flaking 1 : 1

7. After removing a few flakes from one side, selecting another side on the same core, so that the former flake scars get truncated (Fig. 30).

8. Very often in the Chalcolithic industries the stones are beautifully dressed prior to the removal of the blade by ripple flaking. (Fig. 31).

Retouch or Secondary Working

Except the very Early Stone Age tools like pebble tools and handaxes, almost all the tools of the subsequent periods show that after the flake was removed from the core or the parent body, the edges of the flake or the core itself have been marked by further chipping. This is quite marginal, sometimes partial, at times all round, and is described in the literature as "retouch" or secondary working. But this is only one type of retouch. There are others as well. For instance, the thinning of the butt end to facilitate hafting is also a kind of retouch.

The former type of retouch is believed to have been carried out in order to sharpen or strengthen the edge. This explanation is not easily acceptable because in the case of rocks like quartzite, dolerite, or even flint, the original edge is quite sharp.[1] The other

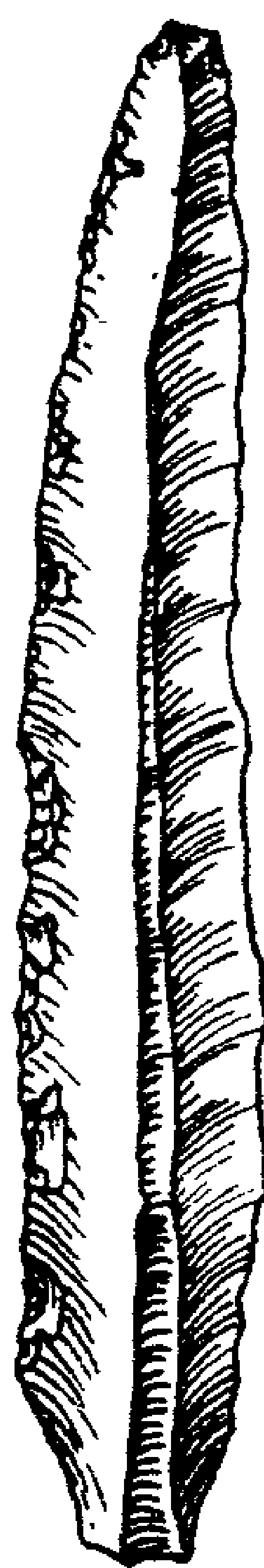


Fig. 32. Nibbling Retouch

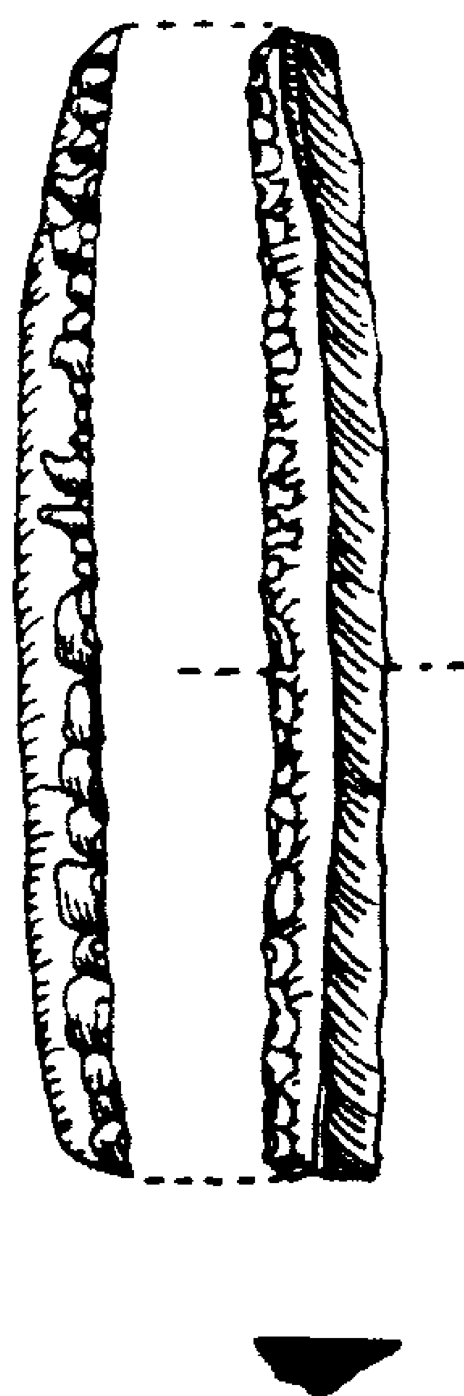


Fig. 33. Oblique Retouch

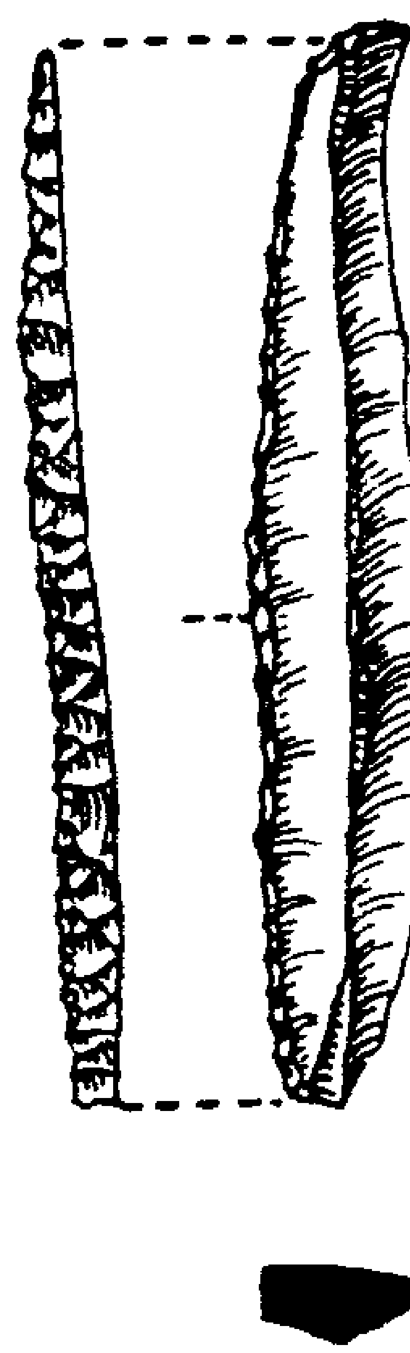


Fig. 34. Steep Retouch

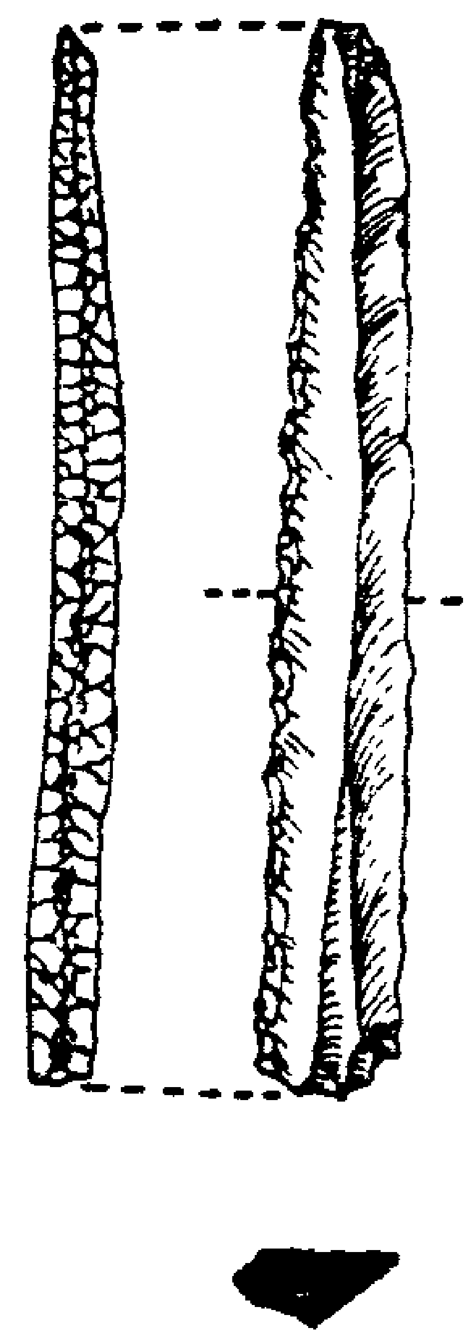


Fig. 35. Ridge-back Retouch

1 : 1

1. It has been observed that in Australia the aborigines use a large number of unretouched flakes for felling a tree or preparing a wooden dish or a boomerang. See, B. Allchin, in *JRAI.*, 1957, p. 125.

suggestion, viz. of strengthening the edge needs to be proved by actual experiment. It is possible that retouch originated in this way. Once the natural edge was damaged by use, man found it convenient to use the same tool, by retouching the edge.

Names of Retouches

Various names are given to retouches according to their character. When the Stone Age man has retouched the edge very carelessly, by small indentations here and there, it is called "nibbling retouch". (Fig. 32). Sometimes when it is at an angle, it is called oblique (Fig. 33), and at times quite straight and very regular. (Fig. 34).

Retouches are sometimes named after the site, as for instance "Heluan retouch", when the lunates found at the Egyptian site of Heluan by Prof. Dorothy Garrod were found to be retouched on both sides of the arc, the upper and the under. (Fig. 35). Later this name has been replaced by another.[1] Garrod herself has now disowned the use of the term Heluan retouch and instead suggested the term "dos d'ane" or "ridge-back retouch" for it.

Technique of Retouch

Retouches can be made either by holding the edge of the tool against a fixed object—stone or even block of wood—and carefully moving it up and down, or by striking with a small hammerstone. LEAKEY notes that such hammerstones "were used for much of the secondary trimming during all the stages of the various Stone Age Cultures". Depending upon the angle and the care with which the operation is carried out, it will give a scalloped surface, having concavities which are deep or shallow, large or small. Another way was to take a sharp, thin-pointed instrument like the walrus tooth—this is possible only when metal tools came into existence—and press it over the edges of the tool. This will result in a fine delicate retouch. Even a modified cylinder-hammer technique, according to LEAKEY, was employed in the Upper Palaeolithic times in Africa for turning out beautiful lance-heads. A small piece of wood or bone, not thicker than a finger, was used to produce very thin skimming flakes.

The retouch first appears on Abbevillian-Acheulian type handaxes and Mousterian points in Europe, reaching its zenith during

1. GARROD, Dorothy A.E. (1957). *The Natufian Culture: The Life and Economy of a Mesolithic People in the Near East.*

the Upper Palaeolithic period. During the Mesolithic, it became the characteristic feature of microliths, distinguishing them from ordinary chips—flakes and blades. But gradually the retouch disappears during the Chalcolithic and full Bronze Age, being infrequent on parallel-sided blades, and surviving on the rare lunates, trapezes and blunted-back and pen-knife blades and tanged specimens. It has no place in the ground or polished stone tool technique which is one of the features of the Neolithic in Western Europe and Western Asia. In India, the situation is complicated at the moment. Its reappearance in the Chalcolithic is due to the survival of the Mesolithic through the Neolithic or an independent revival of an older feature based on different technique.

V

Stone Age Tools: Their Names and Functions

Prehistoric archaeology by and large is a study of stone tools, though it has occasionally to deal with other artifacts as well. Tools and weapons of metal which came into use late still continue with us, and hence it is not difficult to know their use and give them their appropriate names. But it is otherwise with stone tools. These have become obsolete even in countries like Africa and Australia where until the last century they were used by aboriginal tribes. Hence archaeologists have had to coin some names. In these, several factors—form and technique as well as the likely function—are taken into consideration. The latter is guessed either from similar usage today or because such tools were current among primitive people elsewhere, that is, by the help of comparative ethnology. Recently some scholars have taken objection to this method, called "generalised terminology" according to which a given "industry is divided into a series of scraper varieties, points and cores...... on the analogy of modern stone cultures". For a so-called "scraper" or a "point" could be a knife, which is hafted. To avoid such erroneous misconceptions PATERSON groups the tools simply according to the shape and character of the working edge with no attempt at suggestion as to use.[1]

This is no doubt true. For it has been observed[2] that the aborigines in Australia, for instance, use several types of tools, each for specific purpose, such as hunting, fishing, war and ritual. But the same type of tool is not necessarily used for the same purpose

1. PATERSON, T. T., *Proceedings of the Prehistoric Society*, Vol. III (1937), p. 93.
2. ALLCHIN, Bridget, *op. cit.*, p. 116.

in different areas. For instance, a spear-point may be used as a knife, or a dagger. Similarly, two specimens of completely different type may be used for the same purpose by two adjacent groups of people.

However, some names have crept in by convention, usage or mere similarity of forms.

Tools of Early Stone Age

One of the earliest tools was what is now commonly called a "handaxe" or "biface" found at Abbeville in France by Boucher de PERTHES in 1836, but still earlier in England. As the first half of the name connotes, it is a tool to be used in the naked hand, without the help of any handle. This is most likely, but the second part "axe" is quite inappropriate, if the shape and form of the tool are taken into consideration. For invariably it is thick at the butt end, and pointed at the other, or completely symmetrical. So the working end is not broad as in an axe. But the name "handaxe" may apply more appropriately to another tool, which is called "cleaver". It is possibly of equal antiquity, though at the classic site of Olduvai in East Africa it is not found with the earliest handaxes. It only occurs for the first time in Bed III in the evolutionary "Stage 6" of LEAKEY.[1] This is the transitional phase from the Chellian to Acheulian technique. However, handaxes were made on the thick flakes as well, particularly the ovates. The true criterion therefore is that a handaxe is equally flaked on both surfaces as against the "cleaver", "chopper" etc. in which most of the flaking is confined to one face only. So the term "biface" has been introduced in place of "handaxe". The terms "handaxe" and "biface" have become interchangeable.

Pebble Tool

Literally the term will apply to any tool made on a pebble but by usage it has come to be restricted to a class of scrapers, choppers, and hand-adzes in which only the working edge is flaked and the remaining part of the tool is left untouched. These tools are specially characteristic of the Lower Palaeolithic Cultures of S. E. Asia, N. W. India and East Africa.

Such tools were first found at a site on the river Kafu in Uganda, at Olduvai, Northern Tanganyika and some sites on the

1. LEAKEY, L.S.B., *Olduvai Gorge* (Cambridge 1951), pp. 34-37, Figs 1-8.

Sohan and other rivers in Western Panjab. Later, they have been reported from the Vaal river in South Africa, at a cave at Makapan and at Sterkfontein in Transvaal and one or two sites like Ain Hanech in Algeria, and from the East Panjab and several sites in Peninsular India.

Pebble Tool or Oldowan Culture

However, everywhere these pebble tools do not necessarily signify a "pebble tool culture", particularly if the pebble tools are found mixed with handaxes and other tools. At Olduvai and at Sterkfontein[1] alone are pebble tools found in a clear stratigraphical context and are of such a nature that there is no doubt of their being tools. (Fig. 36-37). Hence these are regarded as the earliest

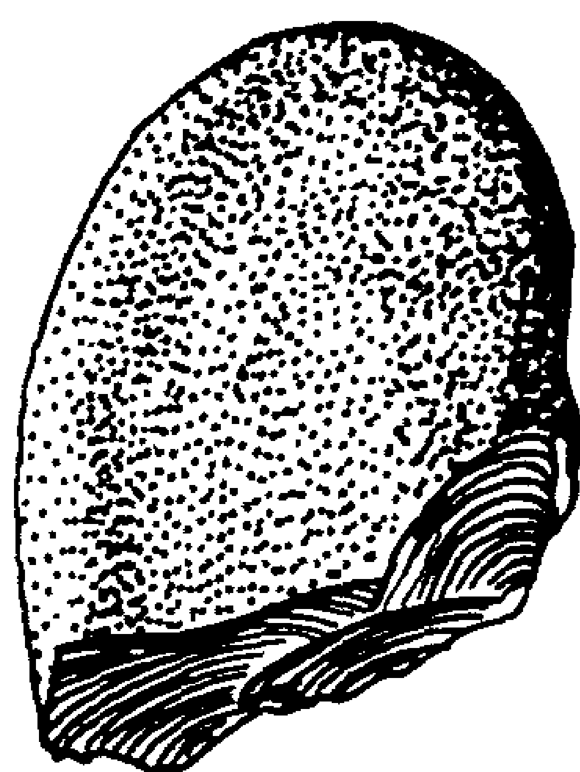


Fig. 36

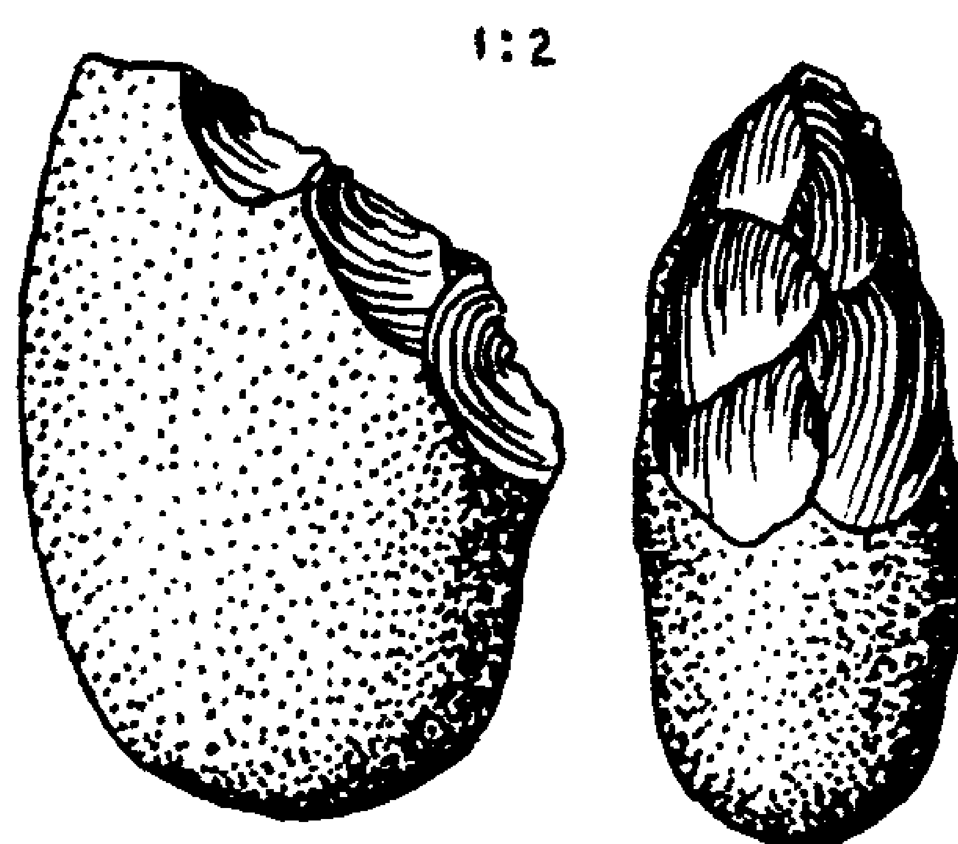


Fig. 36-37. Three views of a Pebble Tool

Fig. 37

pebble tools and used to denote a cultural stage. But even at Olduvai the habitation layer or the actual site has yielded not only tools made on pebbles, but on nodules and flakes as well. Thus the Early Man here (and elsewhere) *did not use only pebbles for his tools and weapons*. Hence Dr. Desmond CLARK[2] has suggested that the term "Pebble Culture" be given up. It should be replaced by the more comprehensive name "Oldowan Culture".

1. *The South African Archaeological Bulletin*, Vol. XVII, 1962, pp. 87-125.

2. In *Atti del vi Congresso, Internazionale Della Scienze Preistoriche e Protostoriche*, 1962 pp. 97-109. LEAKEY had already used this term in 1951 to describe the culture indicated by his pebble tools.

The Kafuan is no longer accepted as a true pebble culture, because doubts are expressed about the very genuineness of the tools themselves.[1]

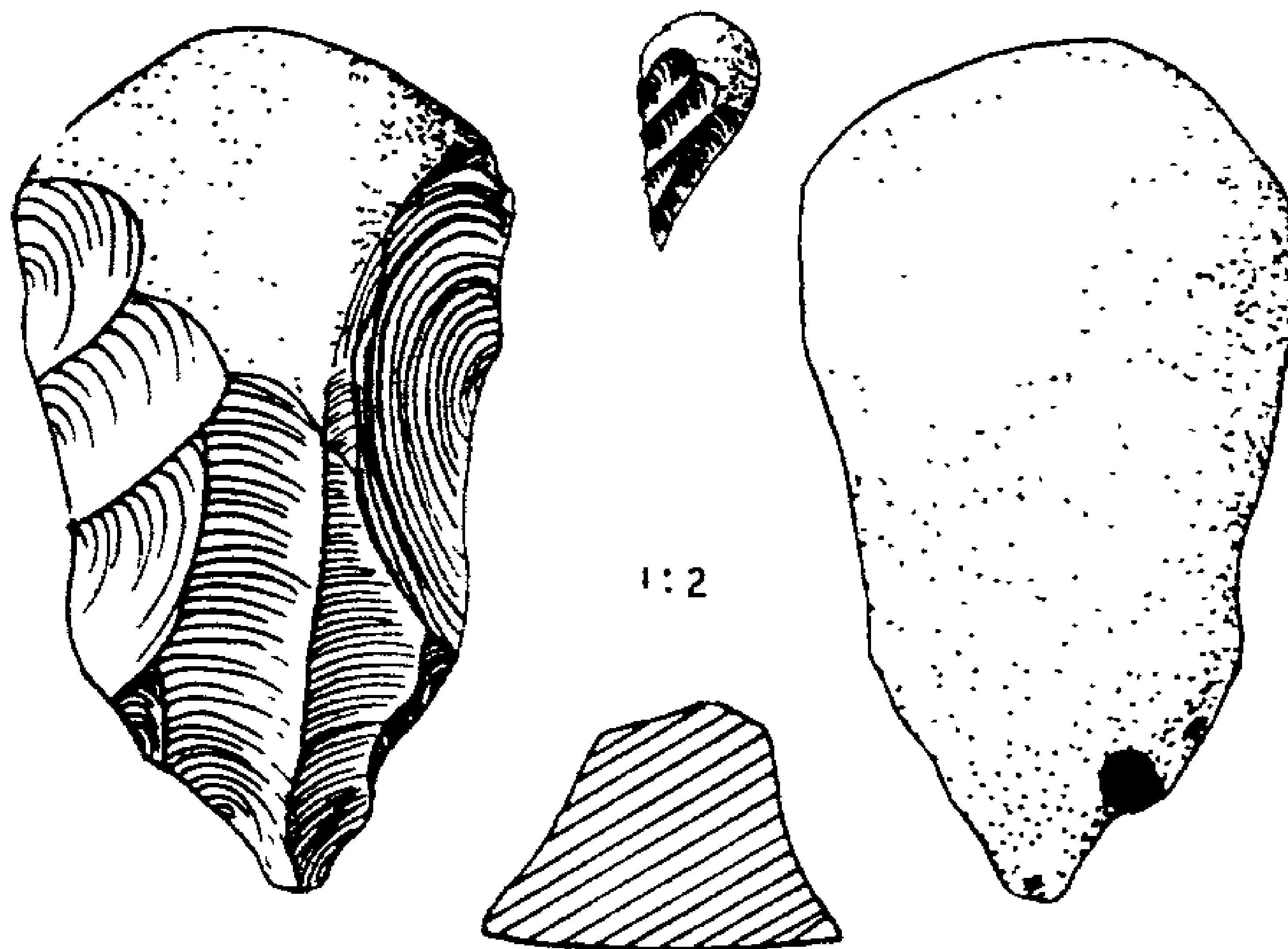
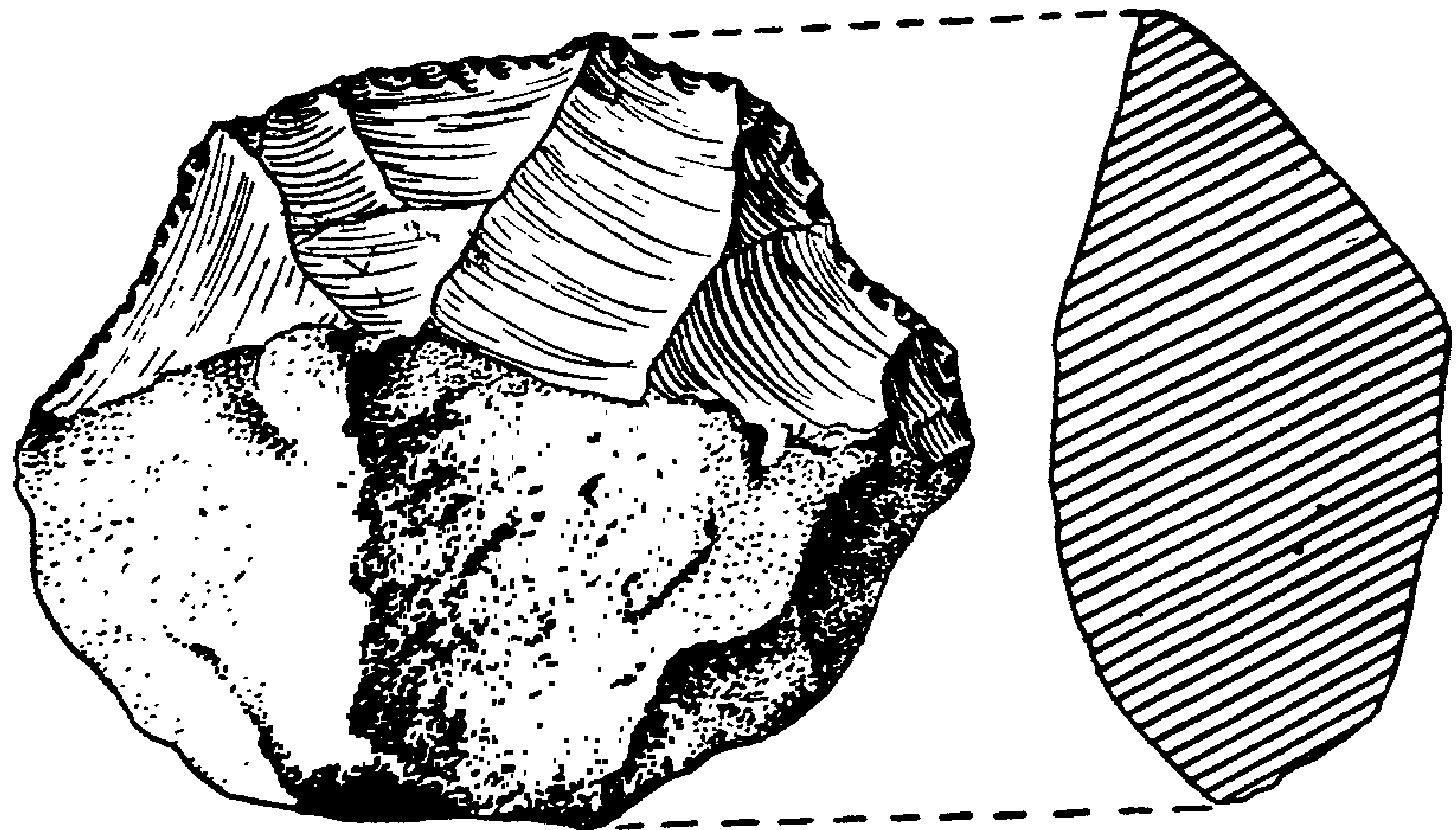


Fig. 38. Unifacial Pebble Tool



Fig. 39. Chopper 1 : 1



At times handaxes are found made on pebbles and these should be described as "pebble-butted handaxes" (Fig. 46) if they retain the cortex, but not as "pebble tools". Where these are unifacial, they have been called—proto-handaxes (Fig. 42).

1. See LOWE, C. van Riet, "The Kafuan Culture", in *Proceedings of the Third Pan-African Congress on Prehistory*, 1955, p. 207, and OAKLEY, Kenneth P., "Tools Makeyth Man", *Antiquity*, Vol. XXXI (1957) p. 204. OAKLEY expresses doubt about the Pre-Sohan flakes. And the arguments he advances can be advanced against a large number of tools East Panjab also.

Chopper (Fig. 39)

This term is used to designate tools which are primarily unifacial and large and massive, that is, worked from one side only. They form a characteristic feature of the Early Stone Age of S. E. Asia, and the Sohan in the Panjab. However, such unifacial tools may occur elsewhere as well.

Chopping Tool (Fig. 40)

It is again a name, partly conventional and partly functional, applied to a tool which is made on a core or a split pebble, and flaked alternately from both surfaces in such a way that a jagged, wavy cutting edge results. The rest of the surface, particularly the butt, might, and usually does, retain the cortex or the original surface. As the name signifies, these tools could have been used for chopping purposes—meat, blocks of wood, etc. Essentially these are quite heavy, large, bifacial tools, appearing first in the Early Stone Age, but later tending to be smaller in the Middle Stone Age, along with scrapers and other tools.

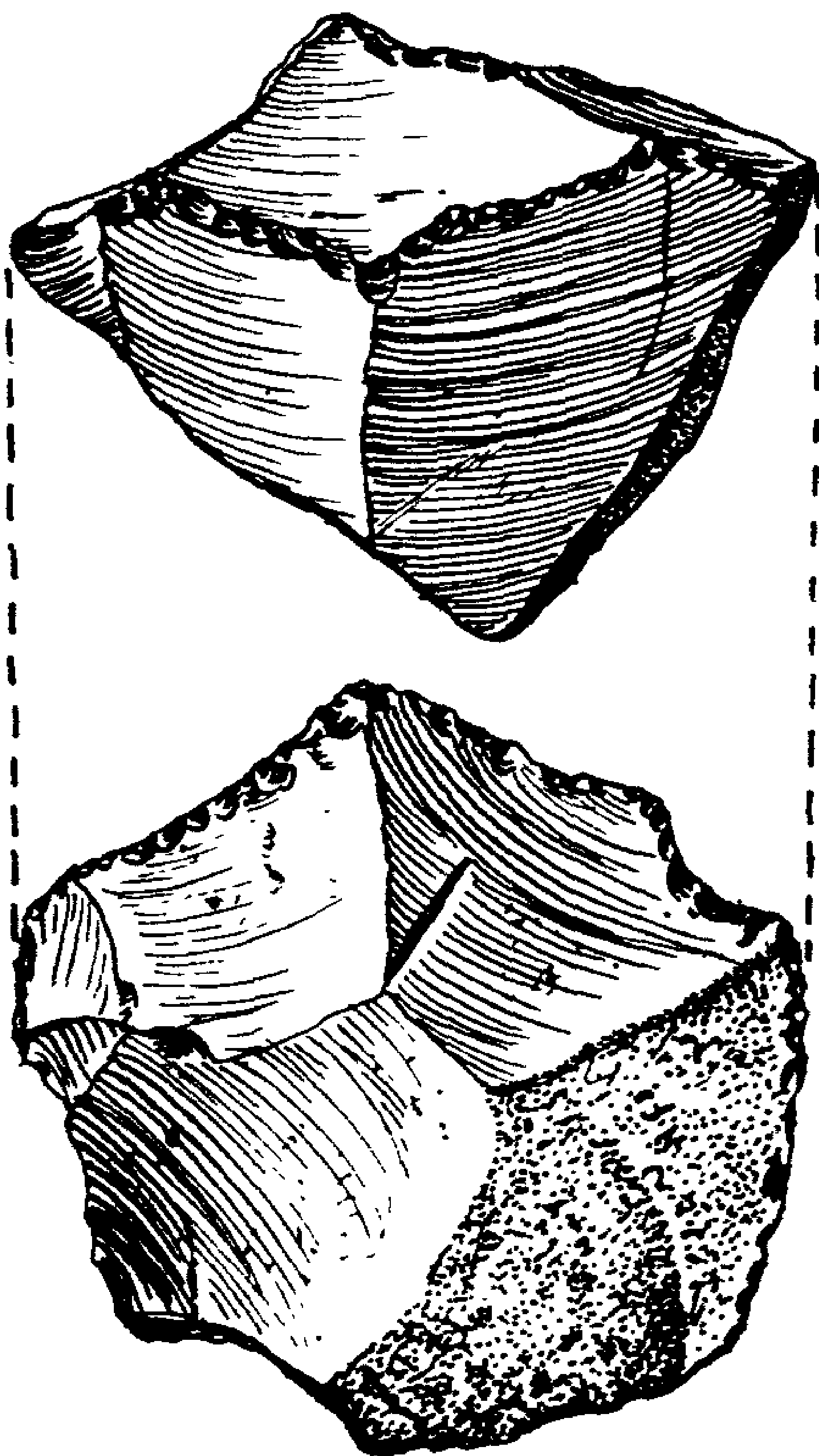


Fig. 40. Chopping Tool with a wavy edge 1 : 1

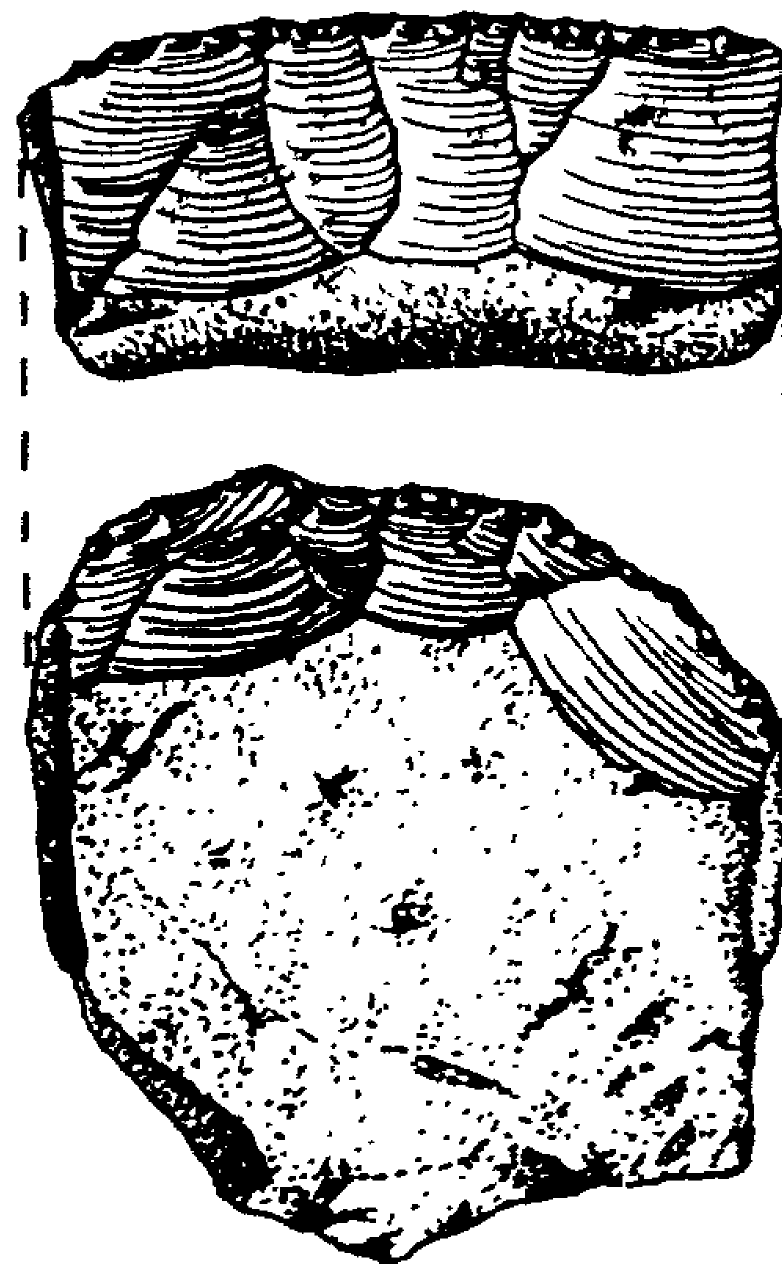


Fig. 41. Scraper 1 : 1

Scraper (Fig. 41)

As Dr. MOVIOUS himself has said[1], size is the only criterion by which a chopper would be distinguished from a scraper. The latter is smaller in size, generally unifacial, and the unworked side provides a suitable hand-hold.

Rostrocarinate (Fig. 42)

Reference must also be made to what is called a "Rostrocarinate". It is a kind of pebble tool which retains the cortex or pebble surface on a part of its back (posterior) side as well as partly on its longer (lateral) sides, but a large flake has been removed

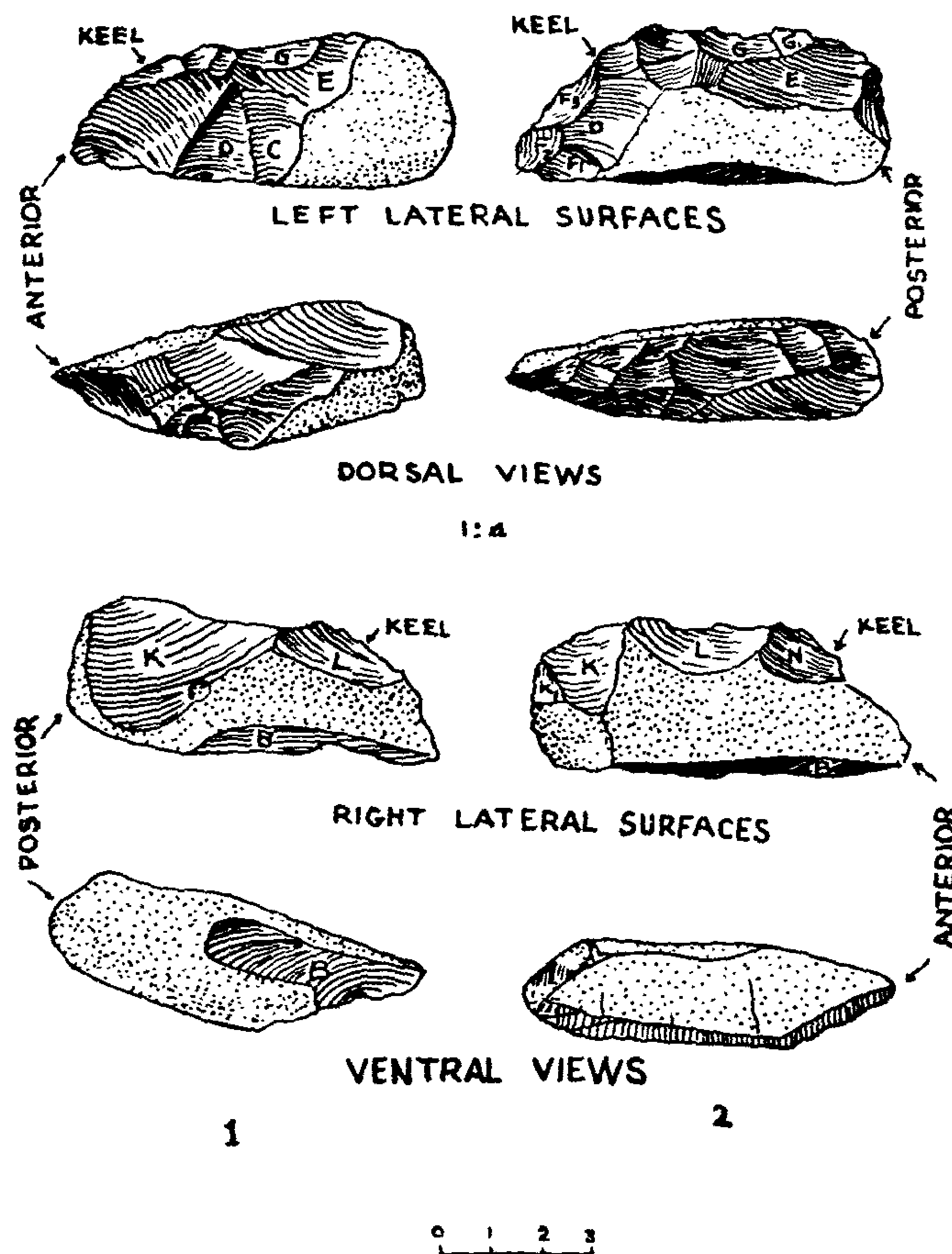


Fig. 42. Four views of two rostrocarinates

1. MOVIUS, Hallam L. Jr. "The Lower Palaeolithic Cultures of Southern and Eastern Asia", *Trans. Am. Phil. Soc.* Vol. 38, 1948, p. 350.

from its underside, while the upper is partly flaked and has a ridge or keel. So the tool has a beak-like appearance, if looked from the front and top. Van Riet Lowe has illustrated it in great detail. This is here reproduced.

Clactonian Core and Flake (Figs. 43-44)

A core primarily is a piece of a stone—a pebble, slab of stone or nuclei—from which flakes have been removed. And as described above, it may be of various types. In this context a flake removed by Clactonian (stone-hammer or anvil) technique from a huge core and the latter found at Maheshwar on the Narmada are here illustrated.

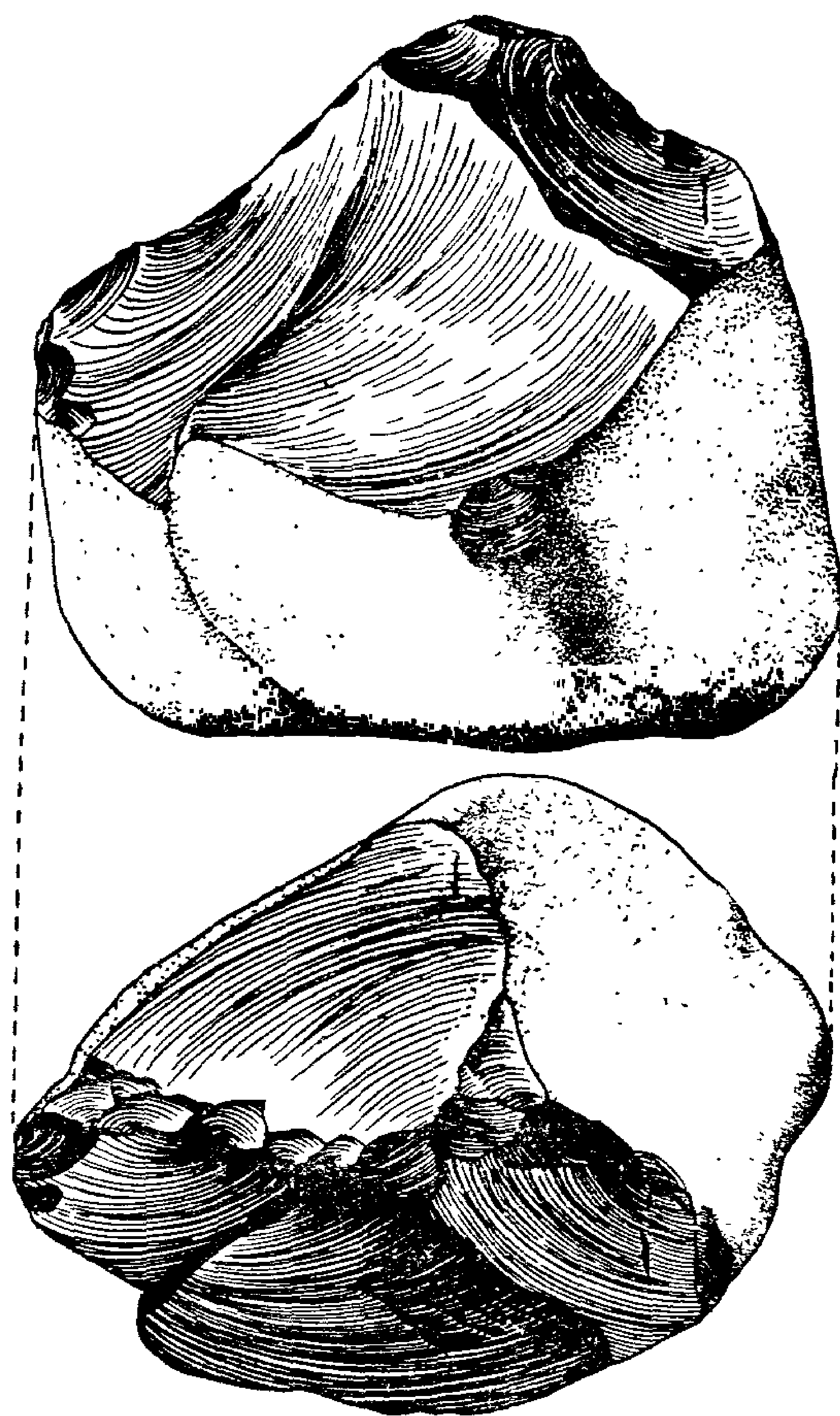


Fig. 43 Clactonian type of core from Maheshwar 1 : 2

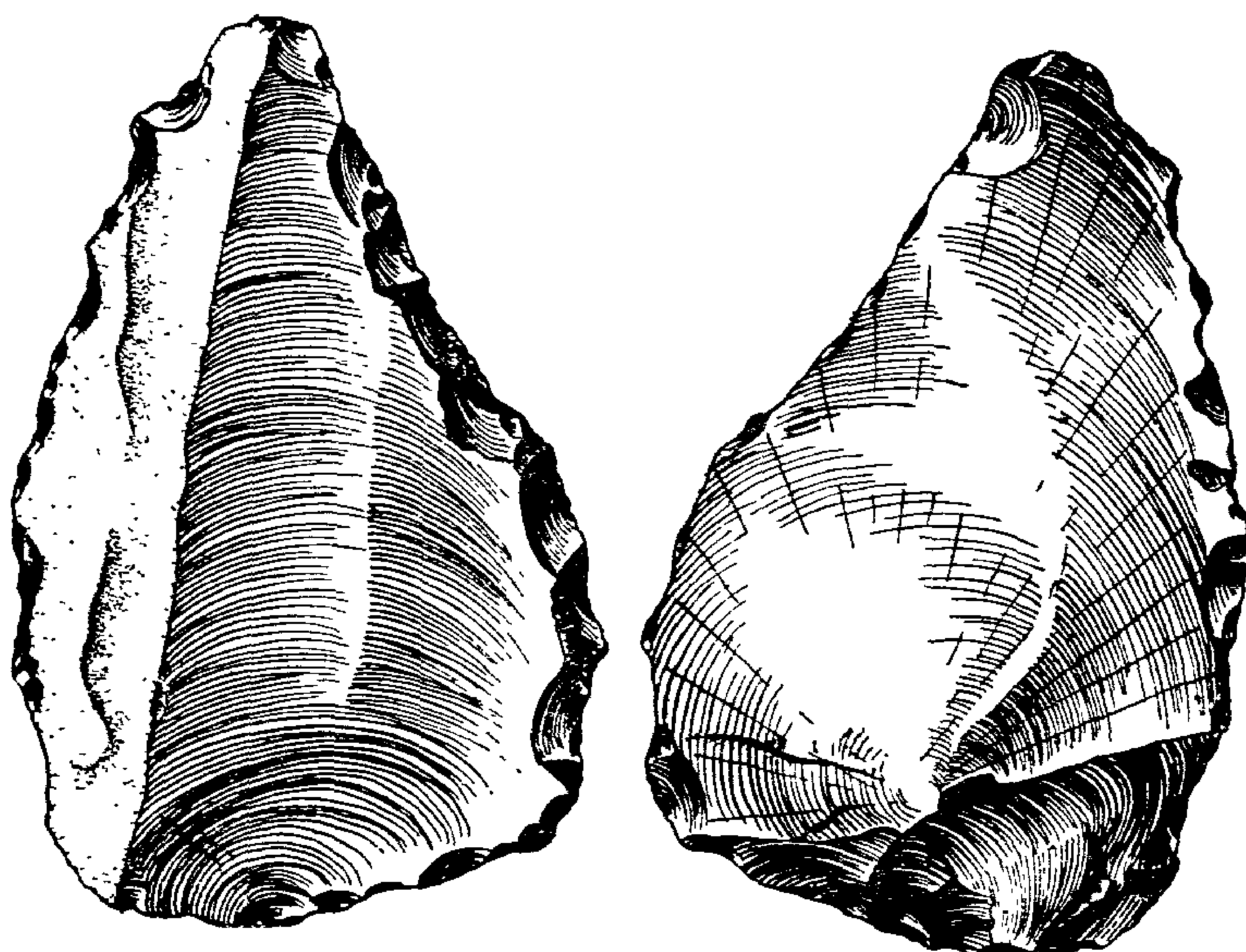


Fig. 44. Clactonian type of flake from Maheshwar 1 : 3

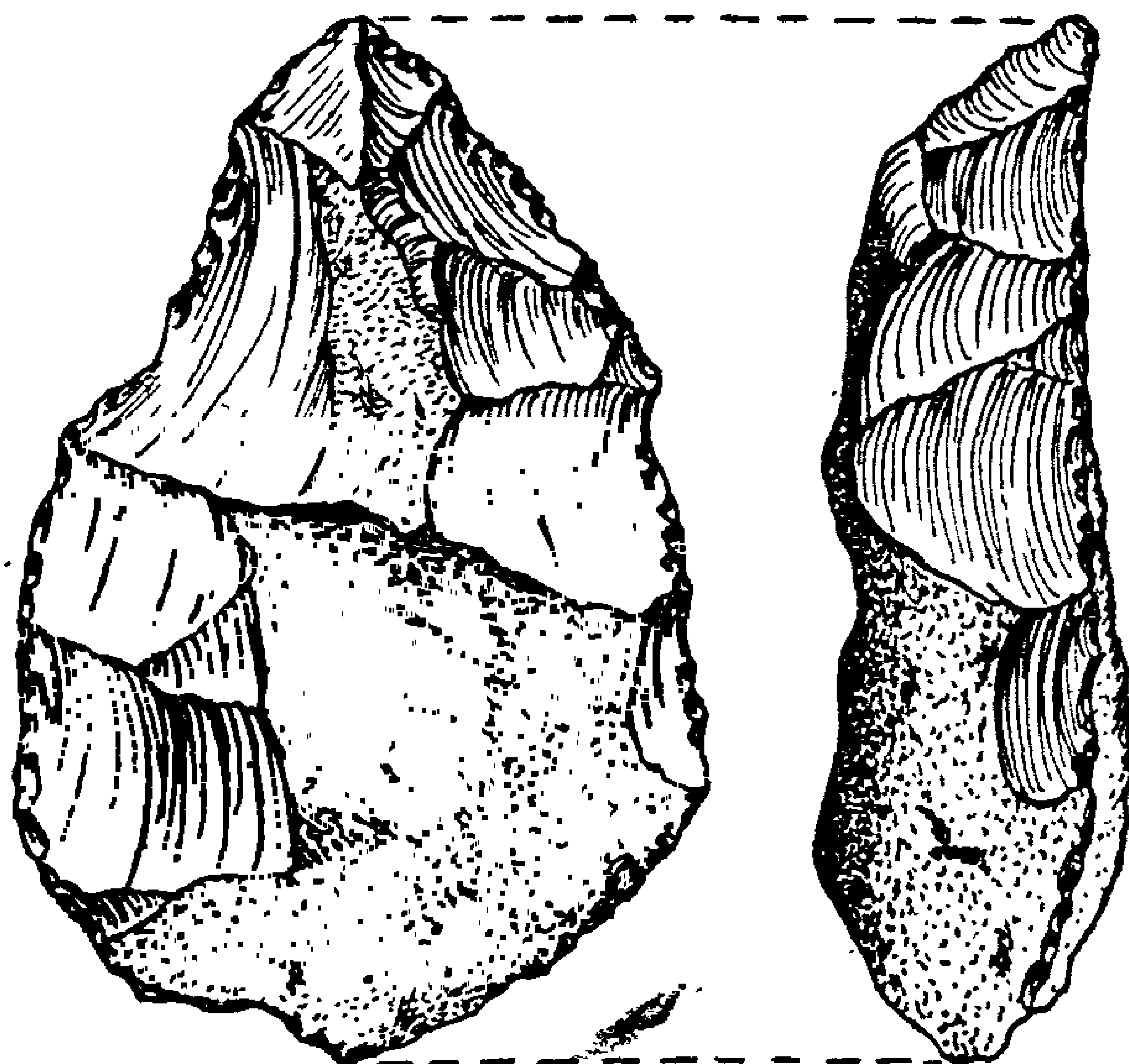


Fig. 44a. Proto-handaxe 1 : 1

Handaxes

Handaxes are distinguished according to shape and technique such as (a) Pear-shaped, (b) Lanceolate, or almond-shaped, (c) Triangular, (d) Cordate, (e) Ovate, (f) Micoquian etc.

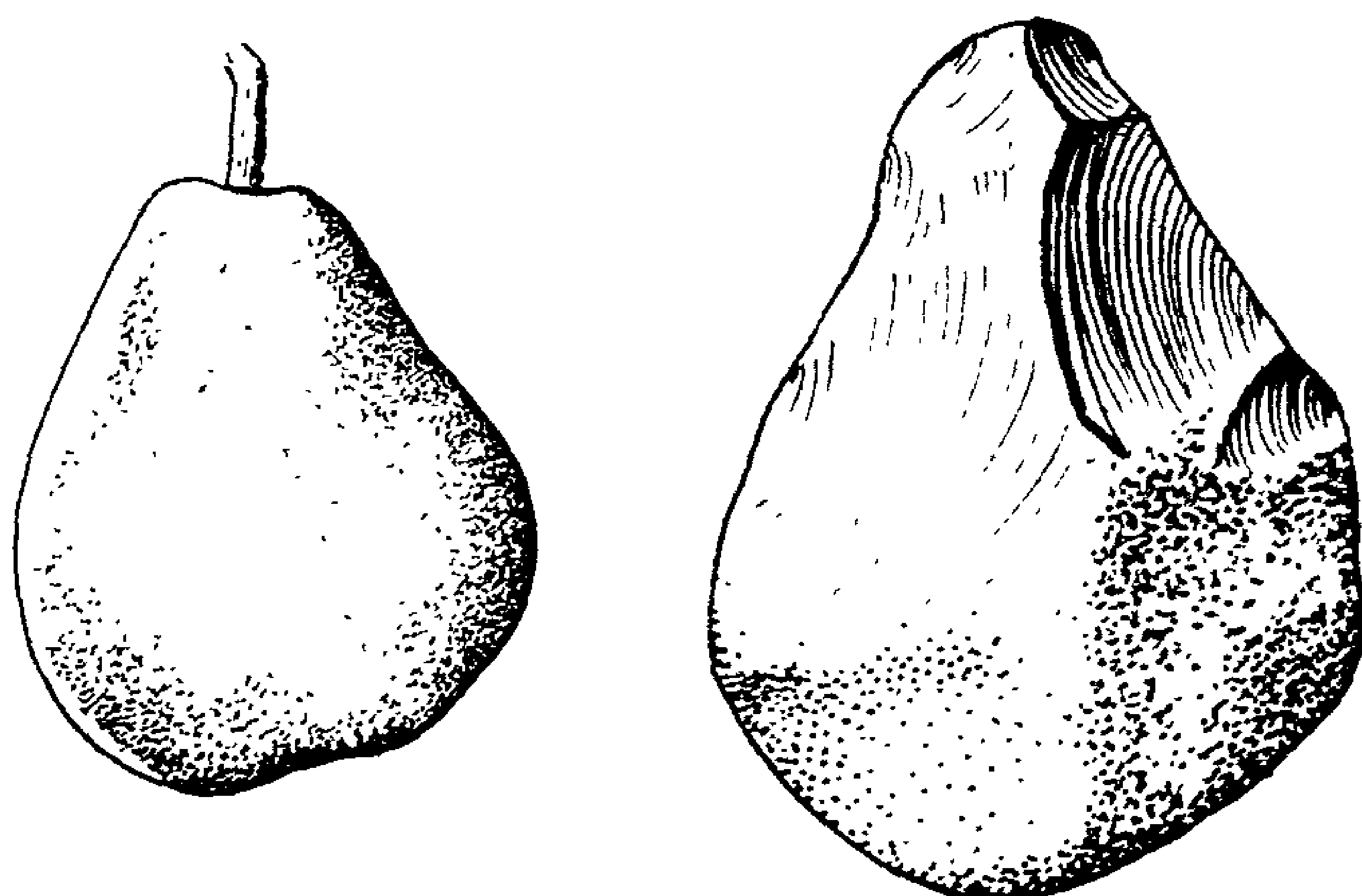


Fig. 45. Left Pear. Right Pear-shaped Handaxe 1 : 2

(a) *Pear-shaped Handaxe* (Figs. 45-46) is one which has a thick, flaked or unflaked pebble butt, and the other end is made by gently tapering sides which meet in a thick rounded point. Such a shape

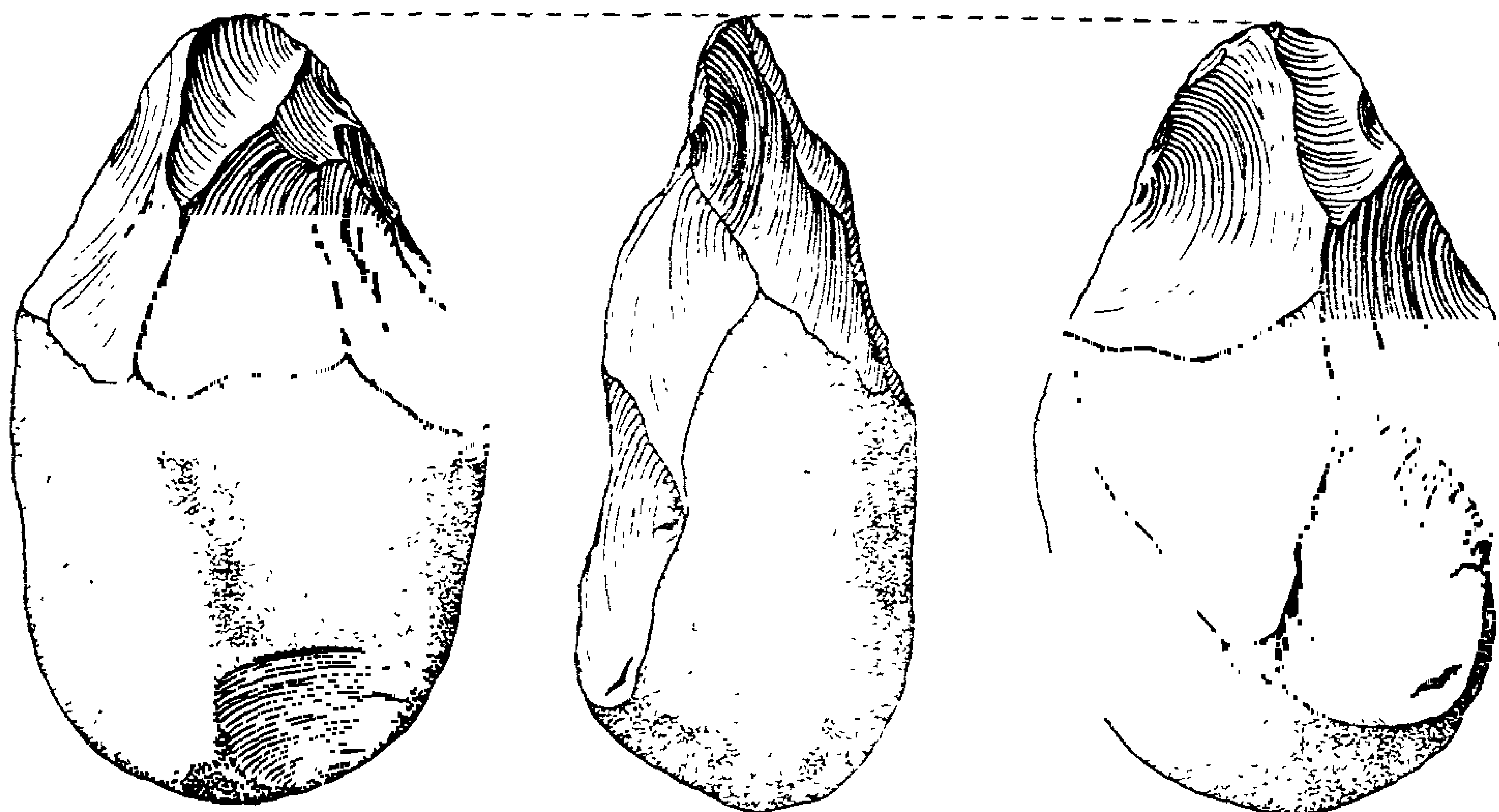


Fig. 46. Pebble-butted Handaxe showing Abbevillean Technique 1 : 2

1. Leakey, L.S.B., *Olduvai Gorge*, p. 97.

reminded the European prehistorian of the fruit 'pear', which grows in temperate climate[1]. Hence the name "Pear-shaped Handaxe". The section indeed varies from specimen to specimen. But in an ideal example, it will be diamond-shaped at the pointed end and roundish at the butt end.

(b) *Triangular Handaxe* (Fig. 47) is one in which the sides meet as in a triangle and the surfaces are flat or almost so. The section will be triangular.

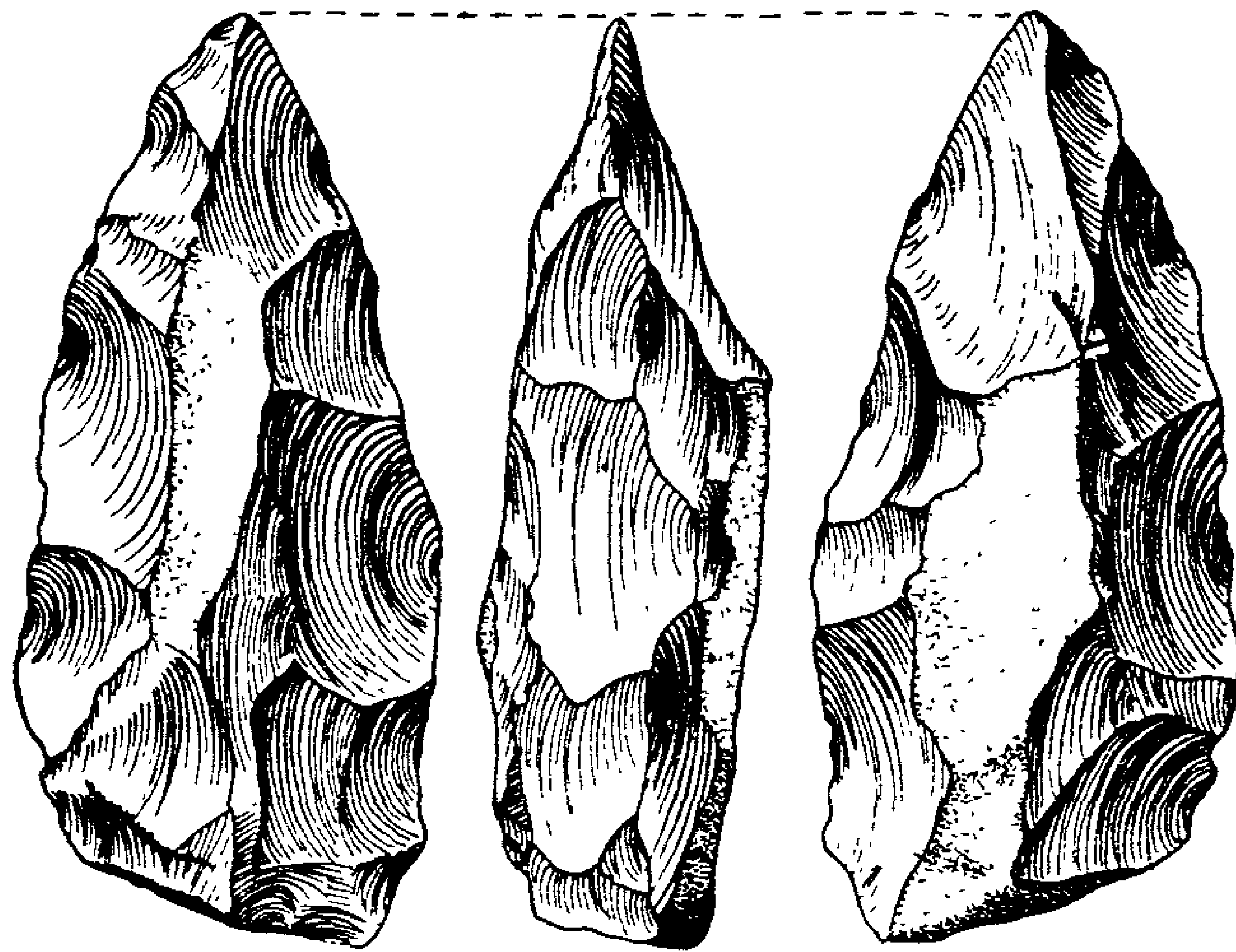


Fig. 47. Triangular Handaxe 1 : 2

(c) *Lanceolate Handaxe* (Fig. 48) is one which has fairly long tapering sides ending in a point and flat surfaces and the width less as in a lance-head—a weapon which was used for offensive purposes particularly by horsemen in charging till 1914-20, but now has become obsolete in many advanced countries.

(d) *Ovate* (Fig. 49) is, as the name suggests, oval in outline and made usually on a flake, often of Levallois type or on Vaal technique; the surface is comparatively smooth; the outlines symmetrical and section lense-like.

(e) *Cordate or Heart-shaped Handaxe* (Fig. 50) is, as the name connotes, fairly symmetrical with broad, rounded butt and gently incurved sides meeting in a point. The section in the finest example will be symmetrically biconvex or lenticular.

1. For an interesting history of this fruit see *National Geographic,* September 1951, p. 332

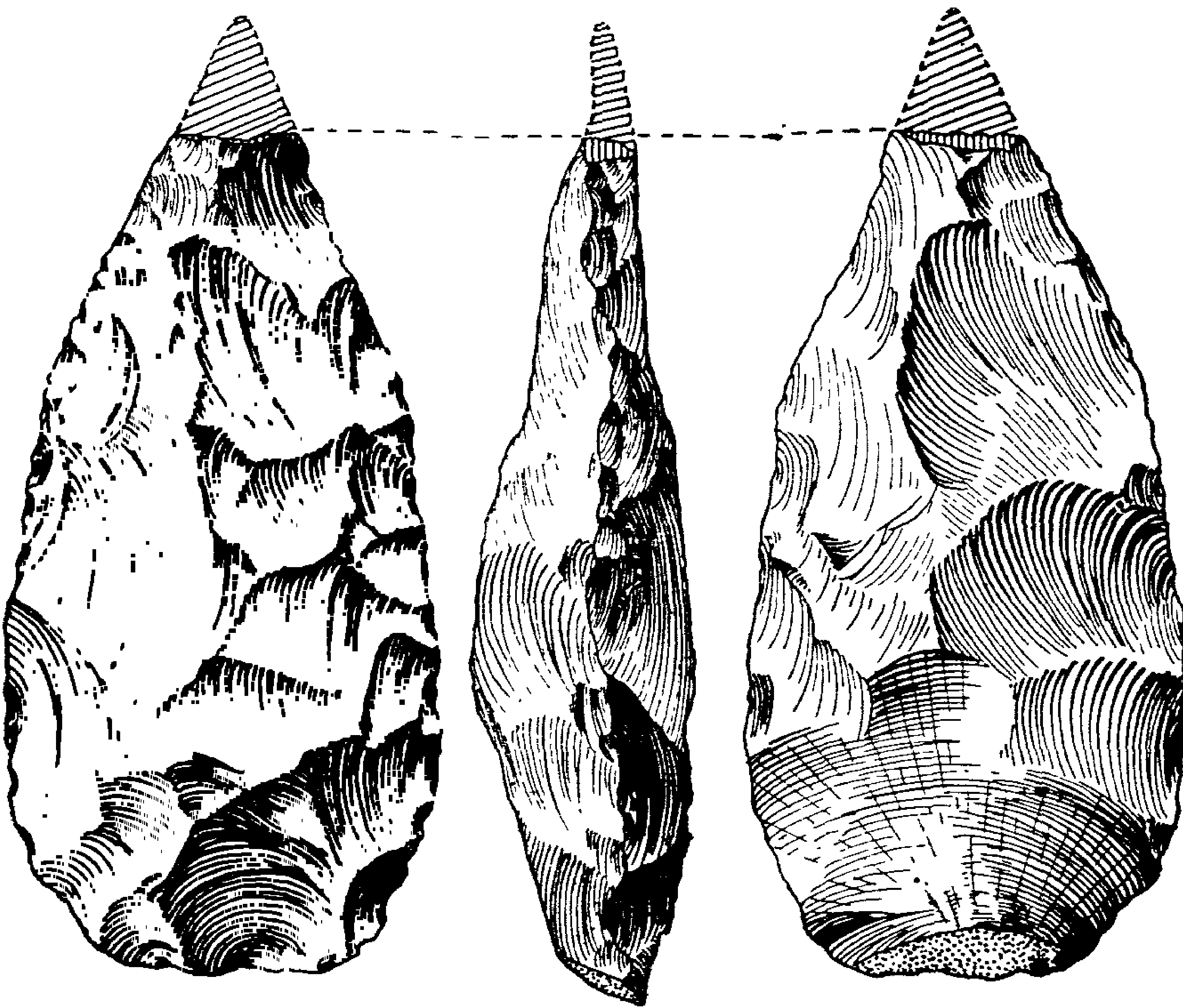


Fig. 48. Lanceolate Handaxe 1 : 2

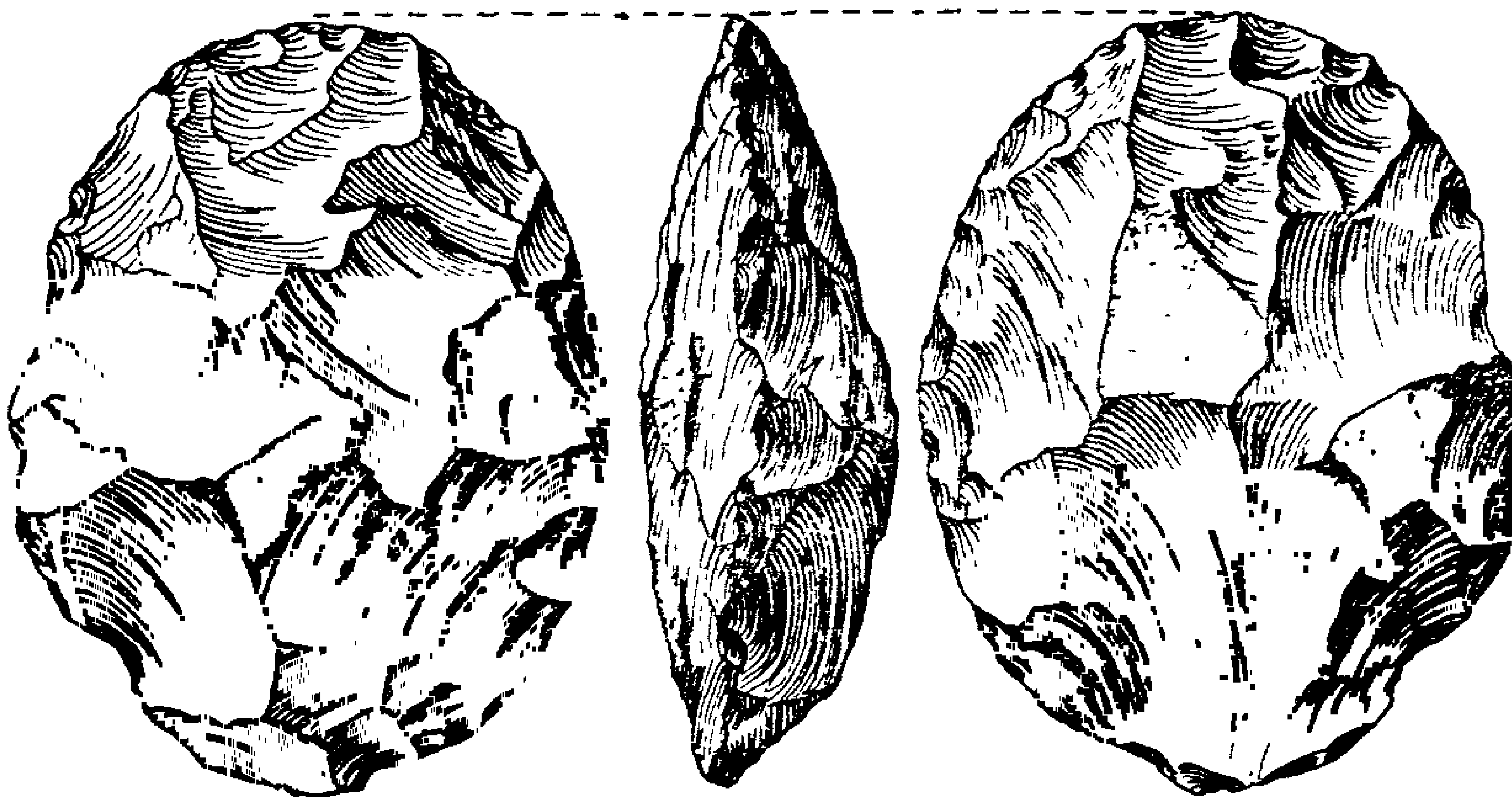


Fig. 49. Ovate Handaxe 1 : 2

(f) *Micoquian Handaxe* (Fig. 51) is a small triangular handaxe with thin elongated point or front. This may be symmetrical or irregular, but has always a thick butt. Since such types of axes were

found at La Micoque in France, they are called Micoquian. Stratigraphically these follow the Acheulian.

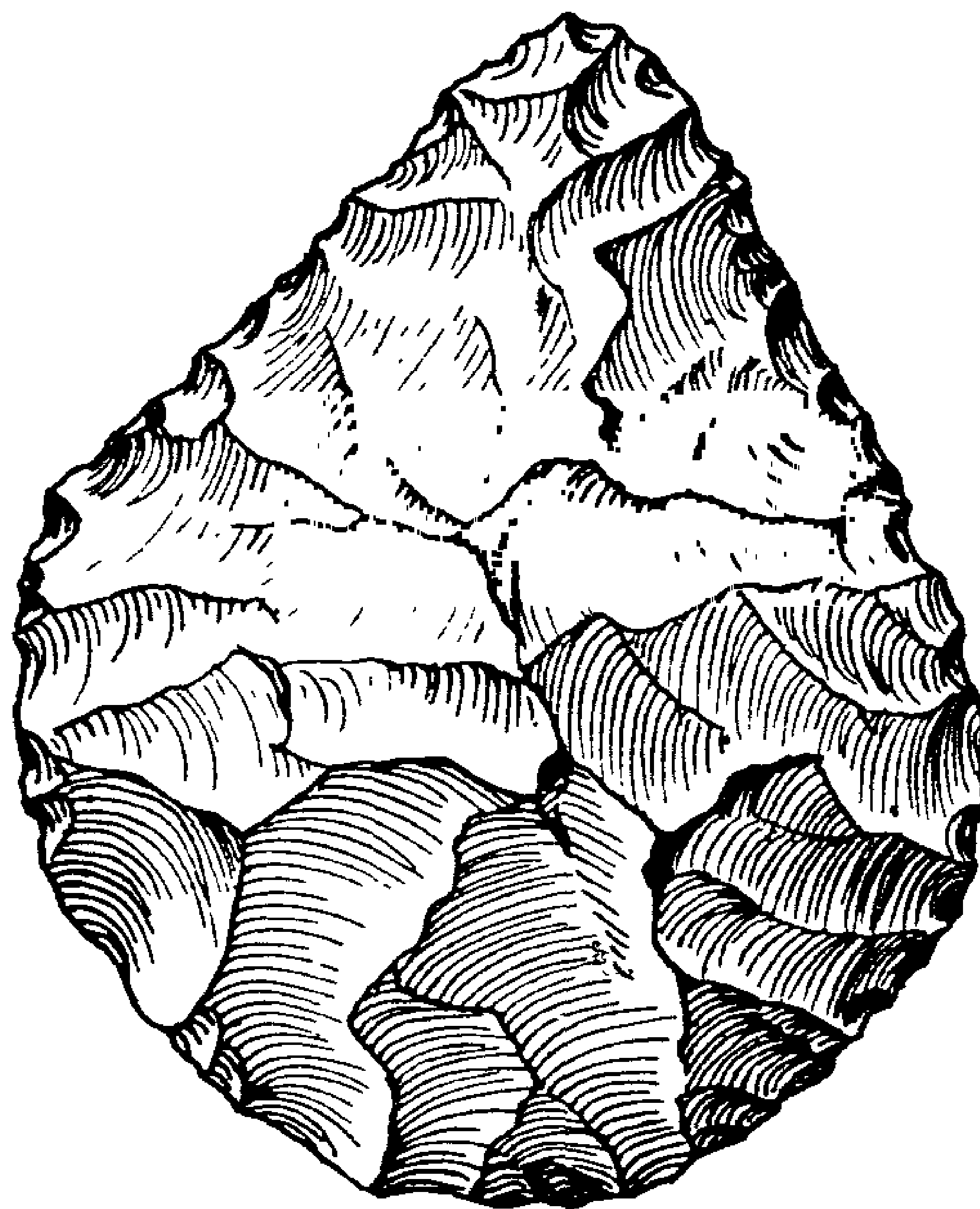


Fig. 50. Cordate Handaxe 1 : 2



Fig. 51. Micoquian Handaxe 1 : 2

Cleaver

This is another important and constantly recurring tool type in the Early Stone Age. As the name signifies, the tool must have been or should be used for cleaving or cutting. And in this sense, it is a distant prototype of our present-day iron axe with a broad cutting edge. In fact, the term "handaxe" is more properly applicable to the cleaver, than to the handaxe itself, though from the point of view of the antiquity of the term, and the tool itself, it is certainly later than the handaxe. At Olduvai its occurrence is contemporary with the transition from Chellian to Acheulian technique. And this is comparatively late in Bed III and Stage 6 of LEAKEY[1].

A cleaver is essentially a tool made on a broad, rectangular or rarely triangular or convex side- or end- flake. At times, one may find a specimen which has been turned out of a core with a pebble butt, or a thick flake, with similar features. Generally the underside is the primary (initial) flaking surface; the upper may retain the

1. LEAKEY, *Olduvai Gorge*, p. 97.

cortex or the pebble surface. The two longitudinal sides which are comparatively thick are trimmed, possibly to facilitate holding or halfting. The intersection of the sloping upper and the (primary) (flaked) undersurface forms the cutting edge. One may say that this is an invariable or characteristic feature of cleavers, whether found in India or Africa, so much so that in some cases not only the butt end, but even the front which slopes steeply to form the edge retains the patch of cortex. In South Africa such flakes were removed after partially preparing the core as in Levallois technique. This was first noticed at a site called "Victoria West"; hence such flakes and cores and the technique involved in them are named after that site. It should be mentioned that flakes struck in an identical manner and further converted into cleavers have been found at a number of sites in India. Of these, the best known to the author are the famous sites of Khyad and Menasgi in Northern Karnatak, the factory site at Lalitpur near Jhansi, discovered by Shri Rameshwar SINGH and Barman Ghat on the Narmada in district Narsimhapur. At the last mentioned site huge blocks of greenish quartzite lie in the river bed. The flakes were removed out of these.

Various types of cleavers may be distinguished according to the

(i) shape or form of the butt,

(ii) form of the edge,

(iii) the nature of the cross section.

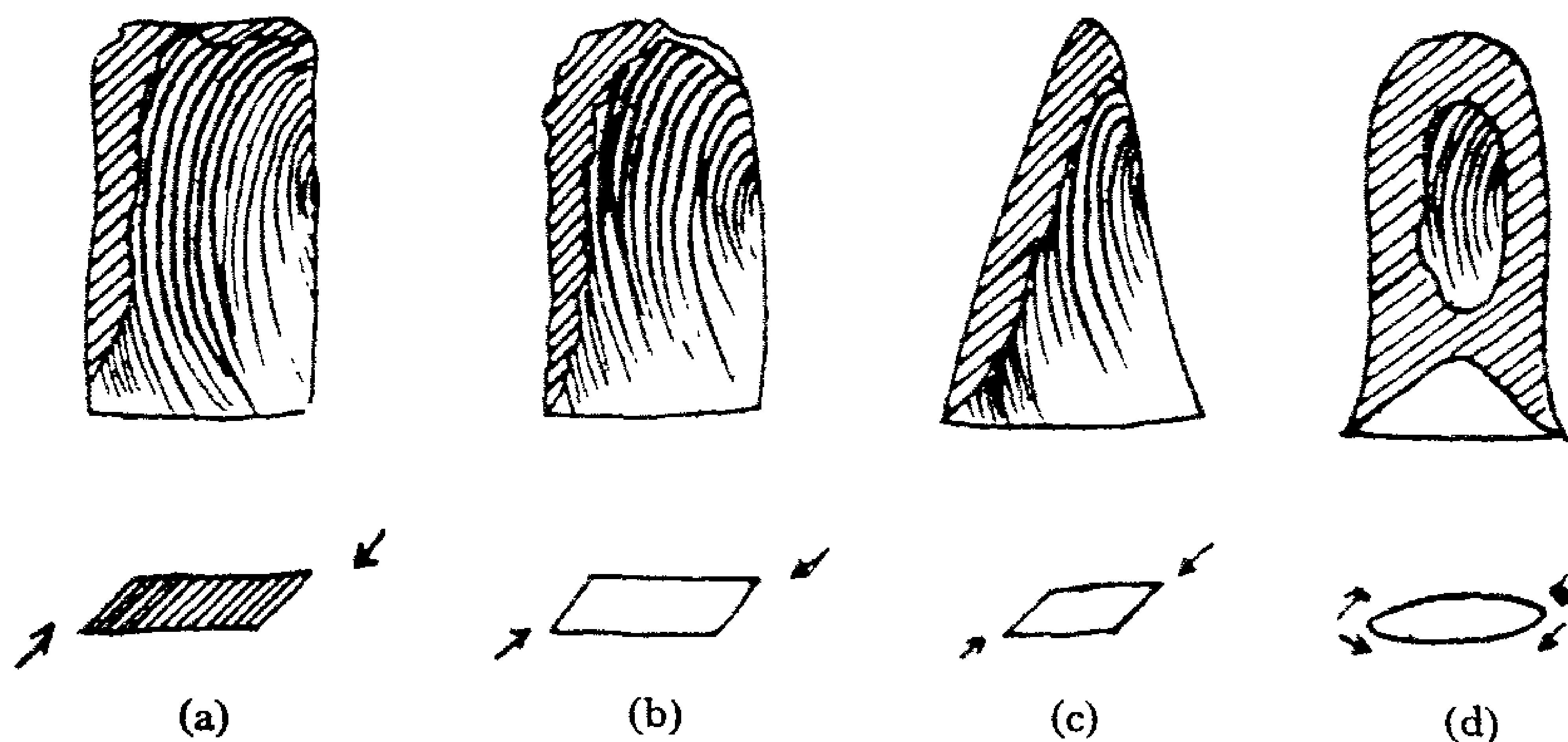


Fig. 52. Cleavers with parallelogrammatic and lenticular sections

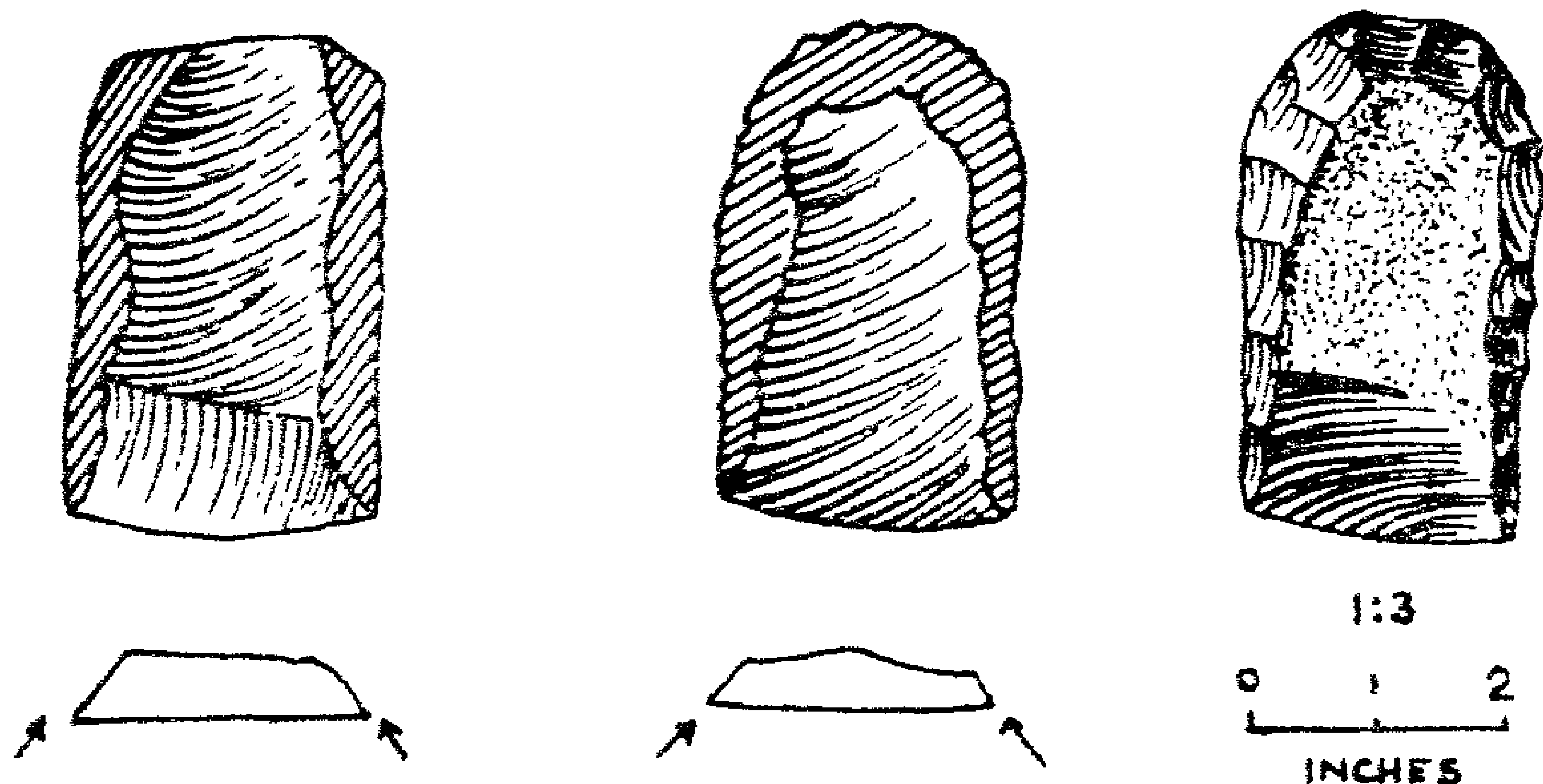
These three characteristics are not exclusive, but have to be considered in each case to understand the exact type. Thus groups of various types and sub-types may be formed. A few of the most important and recurring types are here mentioned.

i. Cleaver with square or rounded U-shaped butt, and straight broad edge. Generally square or rectangular in shape. Figs. 53-54 and Fig. 52, a, b

ii. Cleaver with pointed butt and straight, broad edge. This cleaver will be roughly triangular in shape or like the English letter 'V'. (Fig. 52, c)

iii. Cleaver with broad or narrow butt, and flaring sides. (Fig. 52, d) The edge is straight, convex or concave. With a convex edge it would be like the cobbler's tool for cutting and scraping leather, while the concave edge will help to smooth barks of trees or similar cylindrical tools or objects.

iv. Cleavers with parallelogrammatic section. (Fig. 52, a, b, c) In some examples, from Africa as well as India, the surfaces and the sides are so well made that these tend to form a section like a parallelogram. Since cleavers with such parallelogrammatic section occur in specific stratigraphical horizons in South and East Africa, they have been regarded as connoting certain cultural stages within the Early Stone Age.



Figs. 53-54. Cleavers with irregular and regular outlines

And it may be noted that in India barring the Attirampakkam terraces and probably sites, like Hoshangabad and Mahadev Piparia on the Narmada nowhere a stratigraphical evolution of the tools is visible. On the contrary, almost at all sites, the tools seem to exhibit advanced Acheulian technique and form, almost all being made on what is called "side and end flakes", depending upon the position of the bulb of percussion. (Figs. 55-56). This suggests a comparative lateness in terms of African sequence. However, it remains to

be seen how far this typological dating of the Early Stone Age in India is corroborated by the correlation of gravel horizons with the sea levels.

Cleaver, as the name signifies, is a tool for cleaving, that is, chopping or splitting objects such as trunks of trees and carcases of animals.[1] It has been suggested that the preponderance of cleavers over handaxes in any collection indicates a more wooded environment and the use of heavy wood.[2] Whether it was really so should be proved by other evidence as well. But there is no doubt, as said elsewhere, that the cleavers in a sense are the distant prototype of the flat copper and bronze axes, as well as of the Neolithic axes, though nowhere a direct descent has been traced.

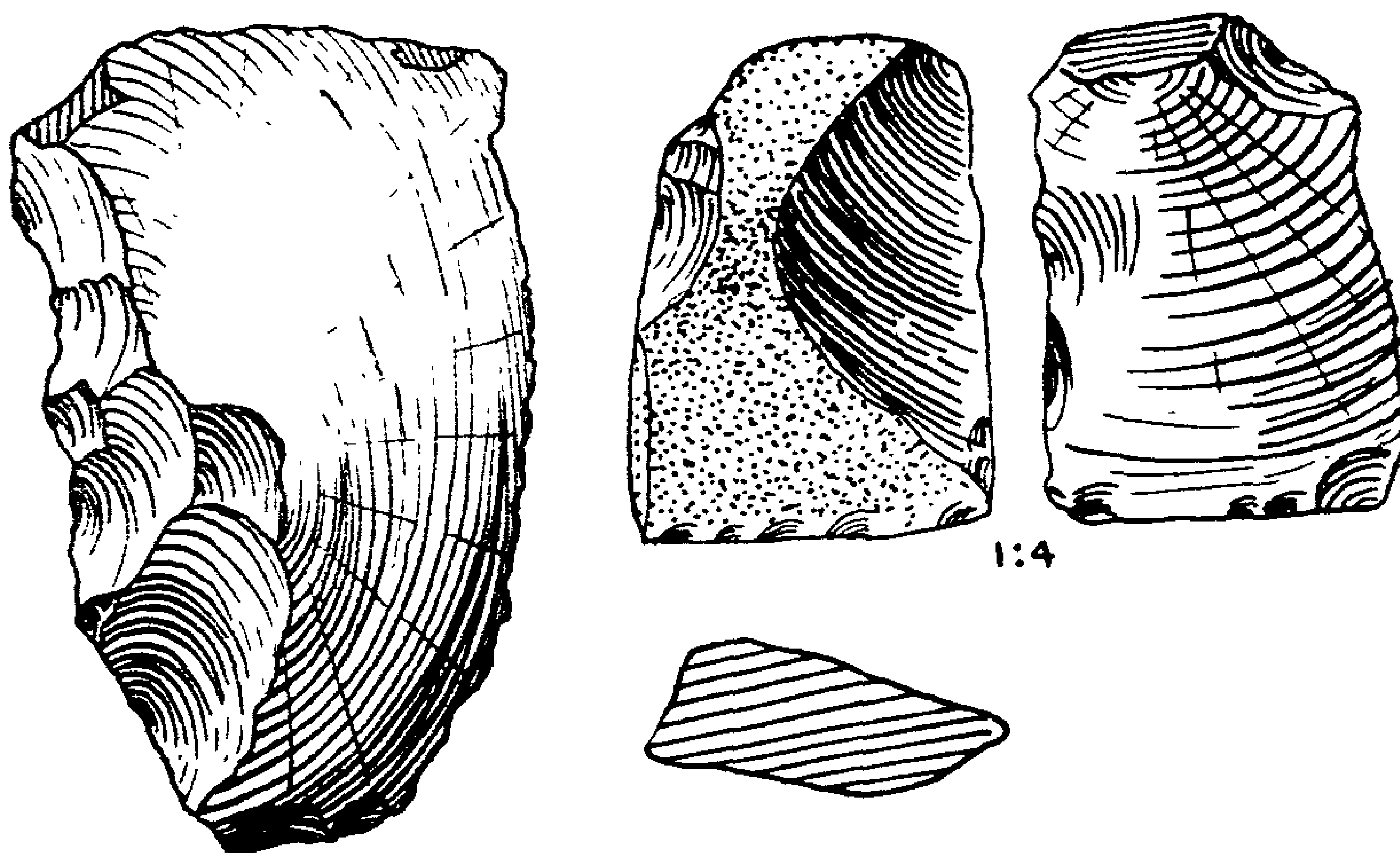


Fig. 55



Fig 56

Figs. 55-56. Cleaver on side flake
Cleaver on end flake

Recently, however, Desmond Clark has pointed out that very few of such handaxes (and we may add cleavers) have a battered edge which would suggest felling of trees. Hence these might have been used for cutting up animals.

1. Clark, J. D., (1960) "Human Ecology During the Pleistocene in Africa, South of the Sahara", *Current Anthropology*, Vol. 1, No 4, p. 315.

2. Zeuner, F. E., *Environment of Early Man with Special reference to Tropical Regions*, (Baroda, 1953).

Tools of Middle Stone Age

Middle Stone Age is at present defined as a period which follows the Early Stone Age (the Lower or Early Palaeolithic period). During this period, the tools were, so far as known today, of stone usually, and as a rule of fine-grained material like flint or flint-like rock, jasper, chert, agate and chalcedony.

These tools are comparatively (only) smaller than the Early Stone Age tools. Stratigraphically they belong to the Second Gravel cycle in most of the Peninsular rivers. This cycle or the gravel, since it contains such fossils as *Bos namadicus* (LYDEKKER[1]) should be at least Late or Upper Pleistocene in date. Typical data come from Nevasa, Nandur-Madhmeshwar and Kalegaon in Maharashtra.

The tools generally comprise :

i. Points

ii. Borers

iii. Borer-cum-Scrapers

iv. Scrapers of various types

v. Small choppers.

Technique

Very largely the tools mentioned above are made on flakes or suitable flat-based nodules. The flakes are removed from the core in Clactonian fashion, that is they have high angles, prominent bulb and no prepared platform at the butt. Very few corresponding cores are found. So it is difficult to know their exact nature, that is, whether these are of true Clactonian or of Mousterian type (see above p. 21 and p. 29).

However, instances are recorded of fine Levallois type flakes and tools made on them, whereas at least one region, viz. the Luni Valley in Western Rajasthan has yielded genuine tortoise cores, as well as flakes of prepared butt type. Thus one can say that during the Middle Stone Age both the techniques—the Clactonian and the Levalloisian—were used in the preparation of the flakes.

There is no evidence so far of the employment of pressure technique; for no fluted cores are found in any of the stratified

[1]According to ZEUNER *op. cit.*, p. 21.

deposits (seen by the writer). But the knowledge of this technique is evident in the retouch along the margin of some of the points, borers and scrapers.

Hence, during the Middle Stone Age all the three principal techniques of flaking were known and employed. It is therefore felt that the tools of this period or industry are genetically derived from the Early Stone Age. This might or might not be so.

In defence of the first view it is argued: (1) that the flakes are largely made in Clactonian fashion; (2) that though the tools are smaller, this smallness is already visible in many of the handaxes, and cleavers of the Early Stone Age from Maharashtra, Karnatak, Orissa, S. E. Rajasthan, and Central India, indicating a progressive diminution in the size of the tools; (3) that some of the large quartzite flakes are turned into points and borers in the Middle Stone Age style.

While this is true, it has to be remembered that by and large the Middle Stone Age tools are typologically, functionally and materially different from those of the Early Stone Age. Not only they are comparatively small, but are made on fine-grained material and *comprise certain tool types only*, among which bifacial tools are very few. The latter again do not evince that fineness and symmetry which one notices in the beautiful ovates and cleavers of the Acheulian type which mark the closing phase of the Early Stone Age. Thus the use of the cylinder hammer technique is not much evident.

A break in continuity of tradition is suggested owing to the climatic or environmental change and appearance of new cultural influences or of another man himself. And these gradually appear to have spread over wide areas, covering the same regions as the Early Stone Age. Where the change took place first, it cannot be said without much more detailed research in several regions. If raw material is to be one of the main criteria for determining this change, then one could suggest areas where fine-grained rocks are easily available. Here too one may notice a gradual transition from the earlier tool types into the later ones. Such considerations point to two or three regions, which are personally known to the writer. The first is the famous site of Giddalur in Kurnool District. The second is the region of the Betwa around Bina explored by Shri Rameshwar SINGH. Here beautiful and comparatively much large implements in flint-like jasper or flint have been found.

The third likely region is the Narbada basin in its widest connotation. Here too large veins of jasper and chert are found at sites like Choli, a few miles north of Maheshwar. And the area for nearly 2 miles around is strewn with large and small chunks of fine banded and mottled reddish-green jasper.

With so much available material, it is surprising that everywhere the man during this Stone Age made comparatively few types of tools[1] and those too in technique and finish inferior than those in the earlier period. This might be attributed largely to his environment, and to some extent to his inherent incapacity or laziness. Whatever be the cause or causes, broadly two main types of tools, as mentioned before, are found. These are (i) scrapers, and (ii) points, awls, and borers, that is, scraping and/or cutting and piercing tools respectively. The absence of larger tools like choppers and cleavers and pointed ones like handaxes seems to indicate a change in the mode of life and environment, (though personally the writer cannot understand how a Stone Age people could do without some large heavy tool, by whatever name one may choose to all it).

With this general introduction the main tool types are described. It should be emphasized once again that these are merely descriptive names, and do not necessarily connote the function. A functional name can be used, if a specialized type is found in a limited area, and used primarily for that purpose.

(a) *Scraper*

As the name indicates, these are ordinarily meant for scraping such things as barks of trees, dressing of thin wooden or bamboo shafts and skins of animals as well as for various cutlery purposes. According to the shape of a particular piece, and the position and nature of the edge for scraping, the tool is named as—

Side Scraper, End Scraper, Round Scraper, Hollow or Concave Scraper, Convex Scraper.

(b) *Side Scraper* (Not illustrated, but see Fig. 81)

Here, as the name suggests, one of the longer sides is obliquely retouched from the upper or under side and forms the principal

1. It is therefore suggested that there were other tools in bone and wood, which have perished.

scraping edge, and the opposite side provides a hand-hold, or is naturally suitable for holding.

At times, such an edge is found on either side of a rectangular flake or nodule and thus would be called a Double-edged *Side Scraper*.

(c) *End Scraper* (Not illustrated, but see Fig. 82)

In this tool type, the edge, made obliquely from the upper surface on a thick flake or nodule with a flat undersurface is on the shorter side or end. This is often steep. Hence the tool is also called "Nose Scraper", because the end or side having the edge is steep like a nose.

(d) *Round Scraper* (Not illustrated)

When on a flattish round flake or nodule, the edge is made by oblique retouch from the upper or under side, it is called a Round Scraper.

In Microlithic industries, small semi-circular flakes with oblique retouch on the concave side are called "Thumb-nail" Scrapers.

(e) *Convex Scraper* (Fig. 57)

The nodule or flake may be of any shape or thickness, the main working edge is convex or arched and obliquely retouched from above or the undersurface.

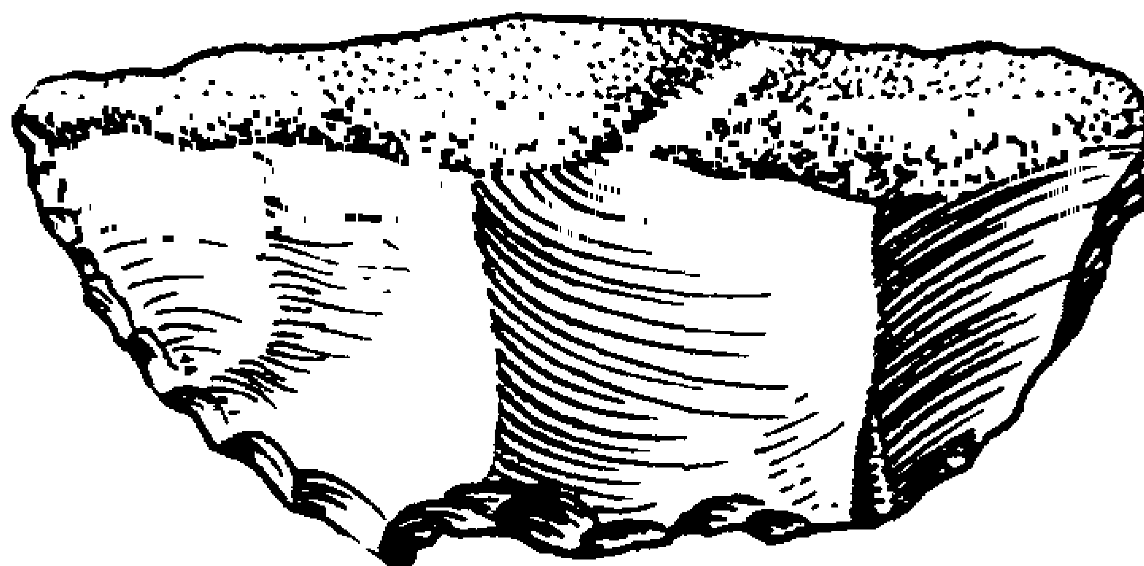


Fig. 57. Convex scraper 1 : 1

(f) *Concave or Hollow-based Scraper* (Fig. 58)

In this variety, a large or small concavity has been made either naturally or intentionally in one of the sides of the sloping surface of the flake or nodule by the removal of a flake. This concavity is obliquely retouched from the upper or the under surface. In rare cases, one may notice such retouch on both the surfaces. Such hollow or concave-based scrapers are not

confined only to the Middle Stone Age; they occur sporadically in the Early Stone Age in India and are a characteristic feature of the Clactonian of Europe. But they are a special feature of the Middle Stone Age and survive into the Late Stone Age microlithic industries.

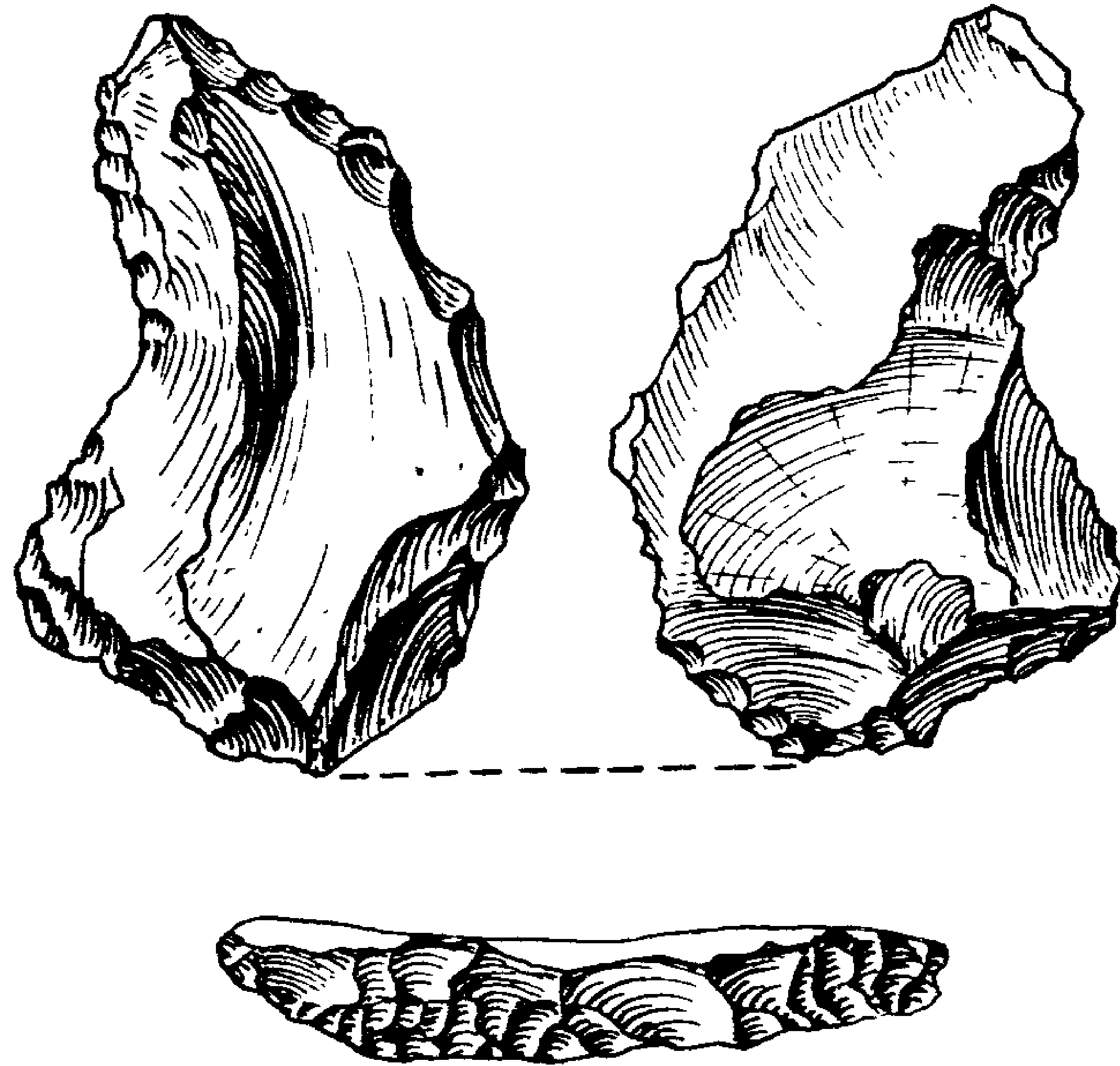


Fig. 58. Concave Scraper 1 : 1

Both in the Middle and Late, but more often in the former, two- or three-sided concave scrapers are found (Fig. 59). This inevitably results in making one or two ends of a side more pointed than the remaining, giving us a crude borer or a borer-cum-scraper.

(g) *Borer-cum-Scraper* (Fig. 59)



Fig. 59. Borer-cum-Scraper 1 : 1

This is another characteristic tool of this period. In a true borer-cum-scraper, the projecting borer end is retouched as also the adjoining concavities. These latter also serve as "guards" or in protecting the object to be bored, as well as the tool itself, and give a suitable hand-hold to the user.

(h *Point* (Fig. 60)

Some one has remarked that this industry has no points. But this remark seems to have been based on limited observation. The industry does include points, large and small, thick, semi-thick and thin, triangular, semi-triangular and roughly leaf-shaped. This may be made either on true Levalloisian flakes, simple flakes or flakes having cortex on one face. But one feature is that either both the longer sides or one part thereof bear intentional marks of retouch and/or use. Sometimes even the upper and/or under surface is carefully finished. Such specimens are indeed rare, but examples from Nevasa and Kalegaon are a thing of beauty.

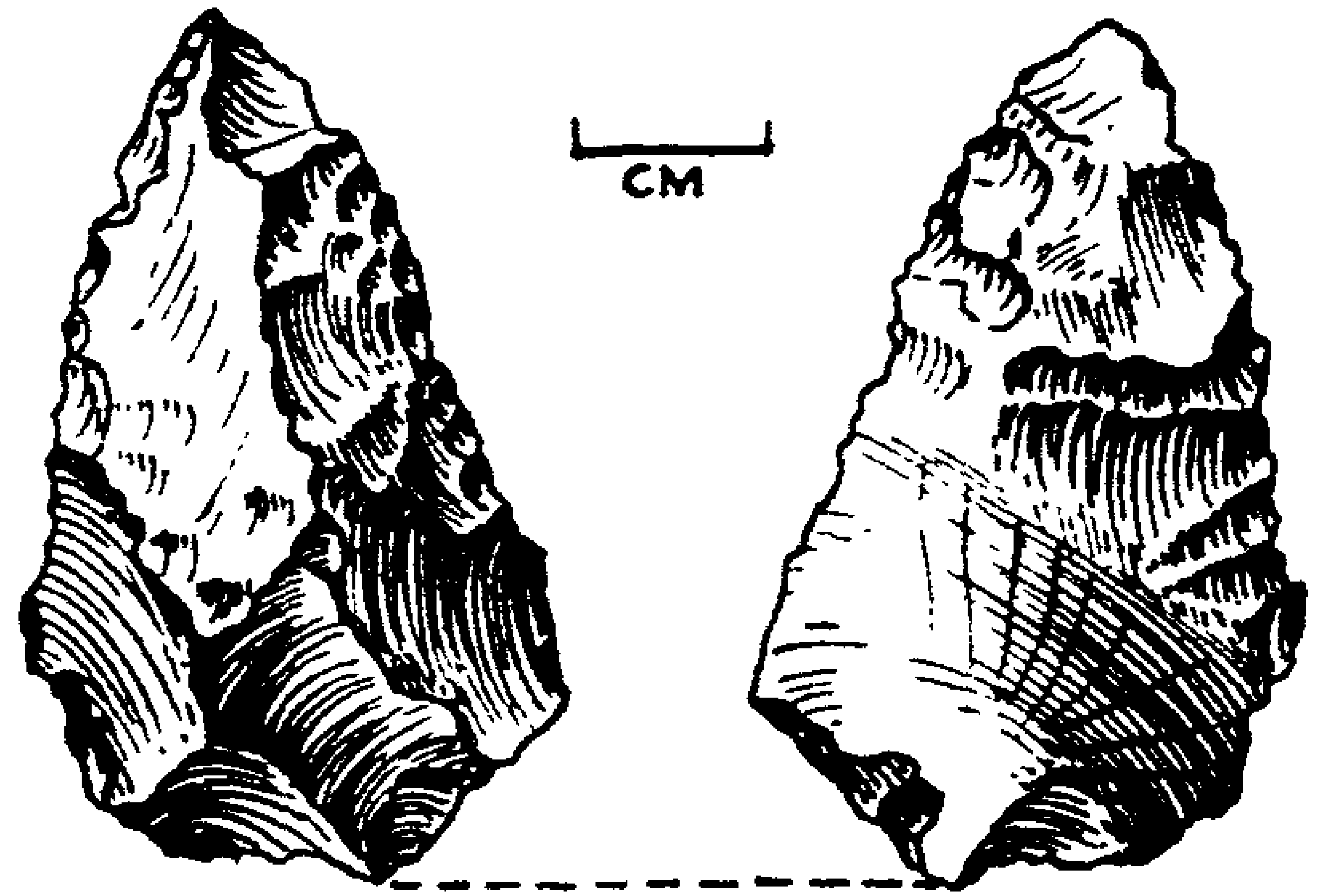


Fig 60. Unifacial Point 1 : 1

No exact use of these points or pointed tools could be suggested. Small, thin, triangular or leaf-shaped points could have served as arrow-heads, whereas the larger and thinner ones with a mid-ridge could have been useful as javelin or even spear-heads.

Point with Incipient Tang (Fig. 61)

Points, borers and even scrapers show occasionally attempts at producing a tang for the purpose of hafting, though these crude attempts are not comparable to the fine Aterian specimens (Figs. 62, 62a).

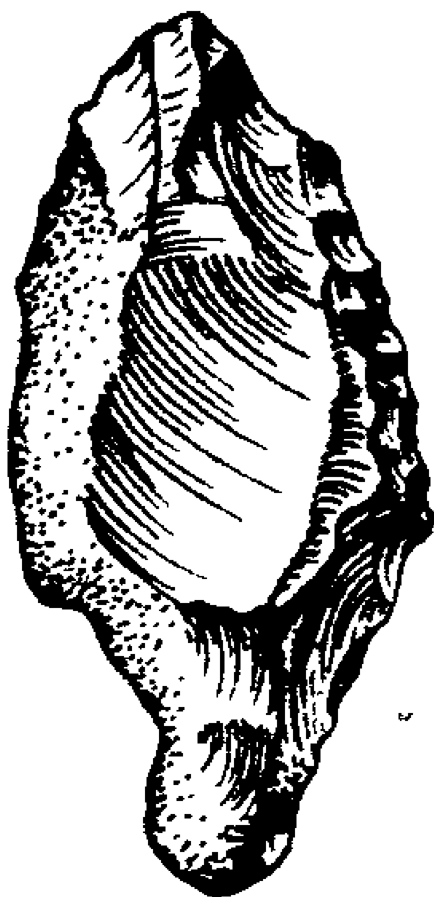


Fig. 61.

Point with Incipient Tang 1 : 1



Fig. 62-62A Tanged Aterian Points 1 : 1

(i) *Bifacial Points* (Figs. 63-64)

These are made on triangular or leaf-shaped flakes, and are worked on both the faces by pressure flaking or cylinder hammer technique. Examples are so far reported from the Luni Valley in Western Rajasthan and the Teri sites in Tinnevelly District in South India, the latter in a microlithic context. A beautiful pressure-flake specimen from Australia is reproduced here for giving an idea of real bifacial points. (Fig. 64)

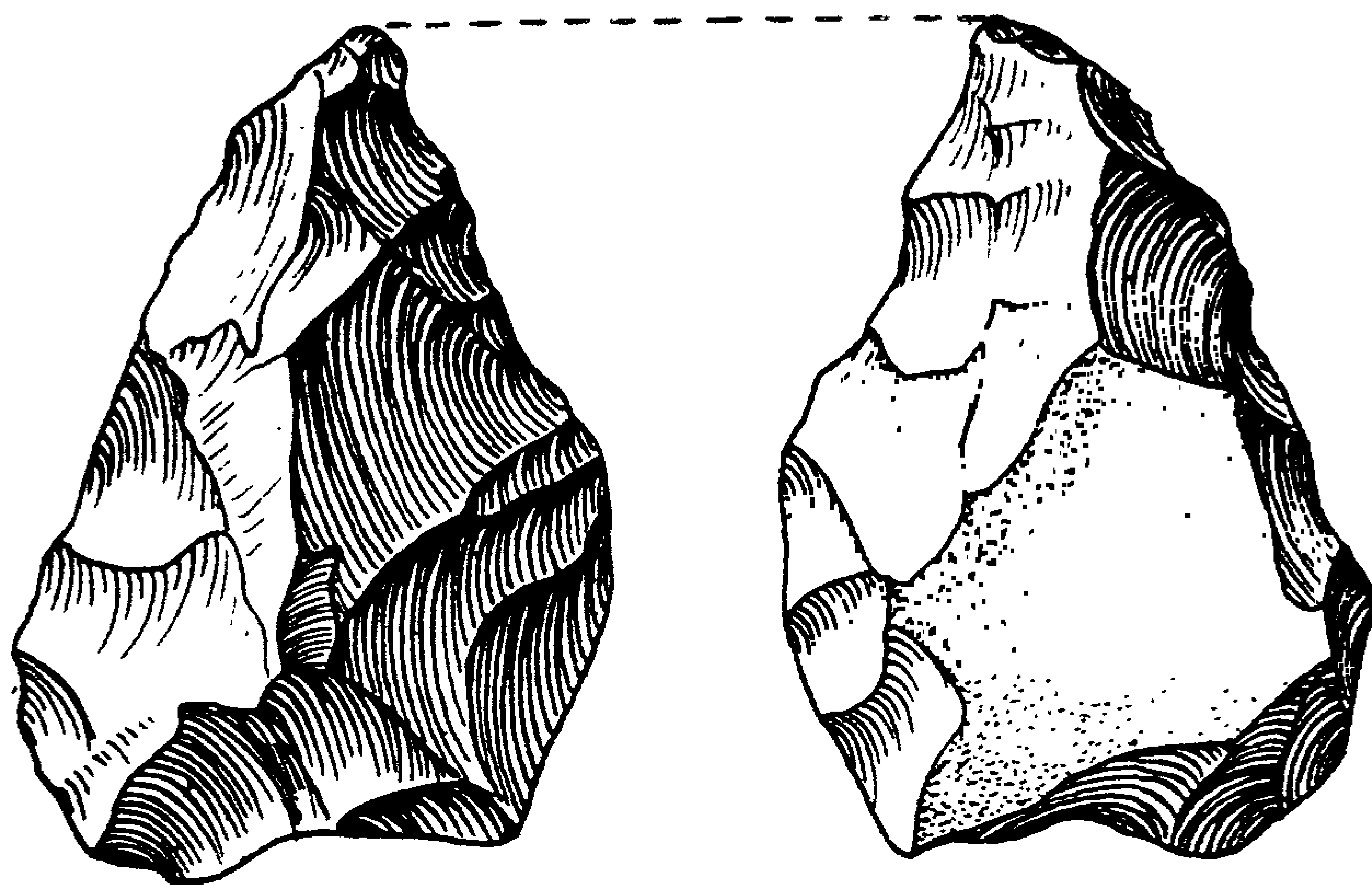


Fig. 63. Bifacial Point from Rajasthan 1 : 1

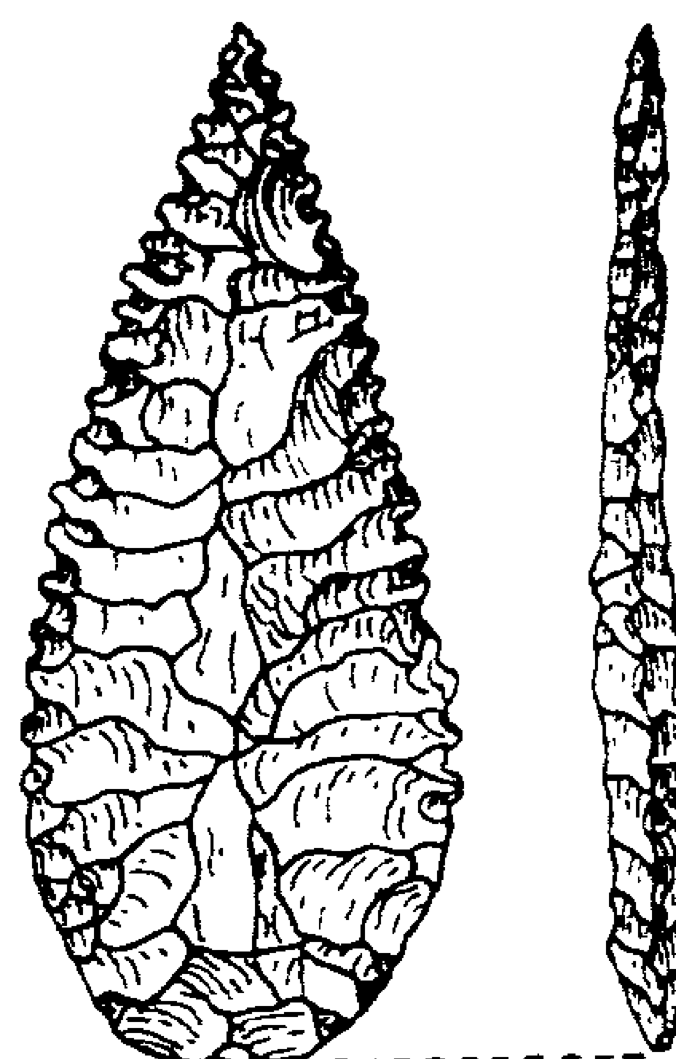


Fig. 64. Bifacial Point from Australia

(j) *Borer or Awl* (Fig. 65)

A true borer has a thick projecting point which has been carefully retouched. It may be a natural point or deliberately achieved by making deep notches on the side of a flake or nodule. This may be small, just a projecting tip or a fairly elongated thick point. The body from which it protrudes may

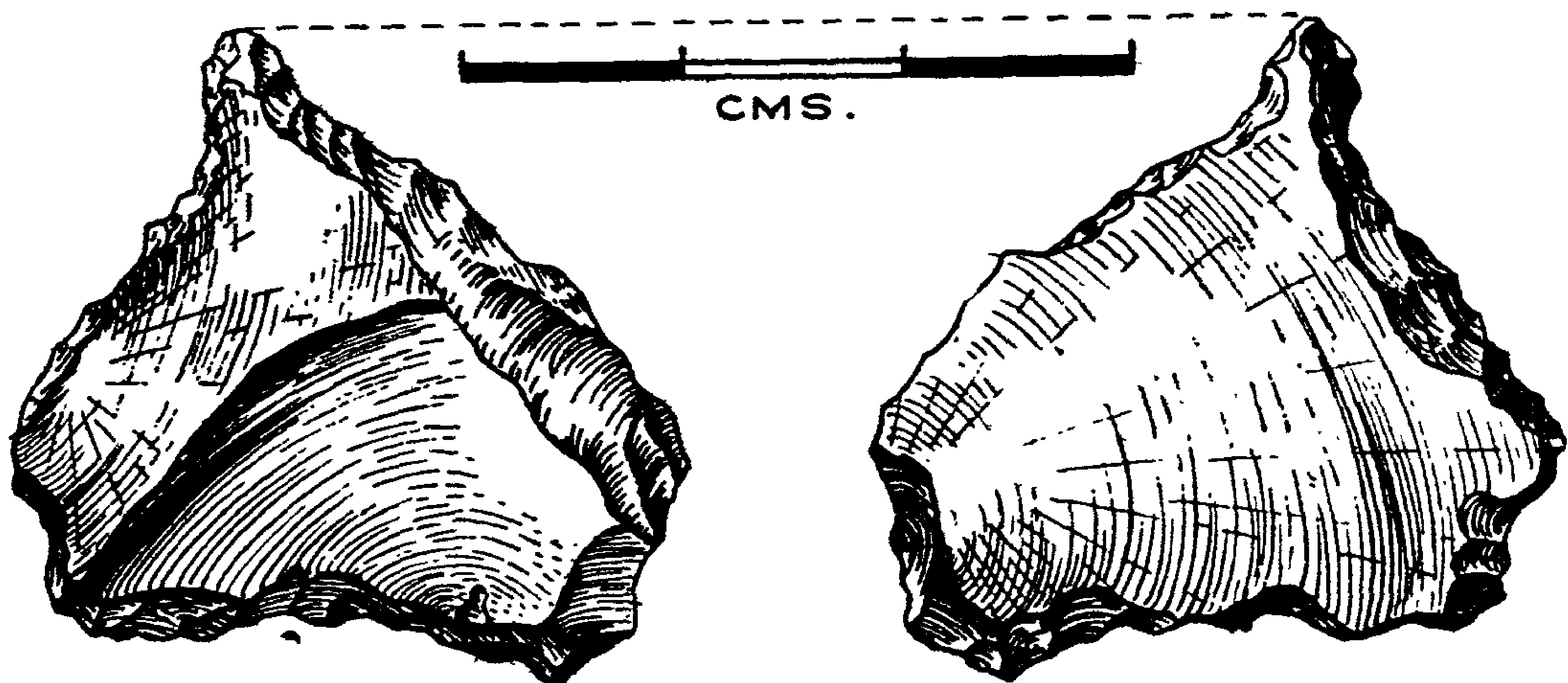


Fig. 65. Borer or Awl 1 : 1

be of any shape, square, rectangular or even round made on a flake or nodule, worked or unworked. It must be said to the credit of the Middle Stone Age man that he had an eye for selecting such naturally pointed flakes and nodules, which by minimum work have been converted into borers and scrapers.

Burin

Such a tool was long regarded as a "hall mark" of certain Upper Palaeolithic cultures of Europe. There they were primarily used for engraving on soft stone or bone and on the walls of rock-shelters and caves, and also probably for making "slots in wood and bone". Hence a burin is called a "graver" and "the original chisel". A burin is thus the product of special needs of man and his environment. Hence whenever a burin is reported from outside such an environment, scholars naturally take it with a pinch of salt. One English writer even went to the length of saying that arrow-marks on the drawings of an alleged burin could not make it one. Though classical and varied types of burins have not so far turned up in India,

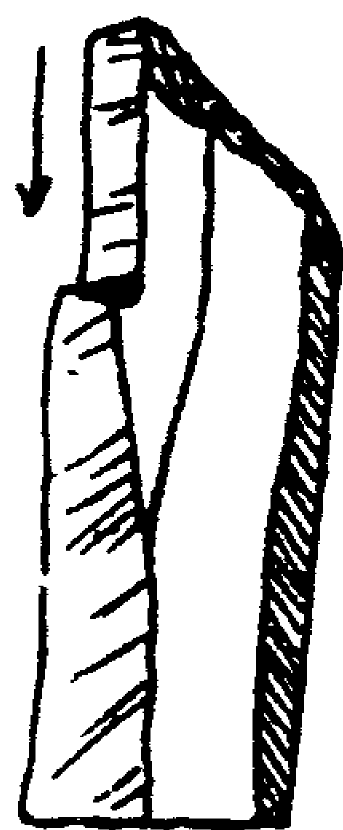


Fig. 66.

Single ended Burin 1 : 1

still occasionally a few specimens with only one side (and still rarely two sides) intentionally removed by the method here described have been found and more may be found in future. Hence some idea of the burin technique is necessary. However, until fuller evidence is available, we can only guess of their probable use.

Burin (Fig. 66)

A burin is a small chisel-like tool on a blade-like flake, having a sharp but thick-set cutting edge, formed by the intersection of the bevelled or sloping surfaces. There are various types of burins, but one most common type is called " burin *bec-de-flute*".

Such burins are made on blade-flakes. (Fig. 67) "Now to convert it into a burin, its one end is trimmed a little on both sides,

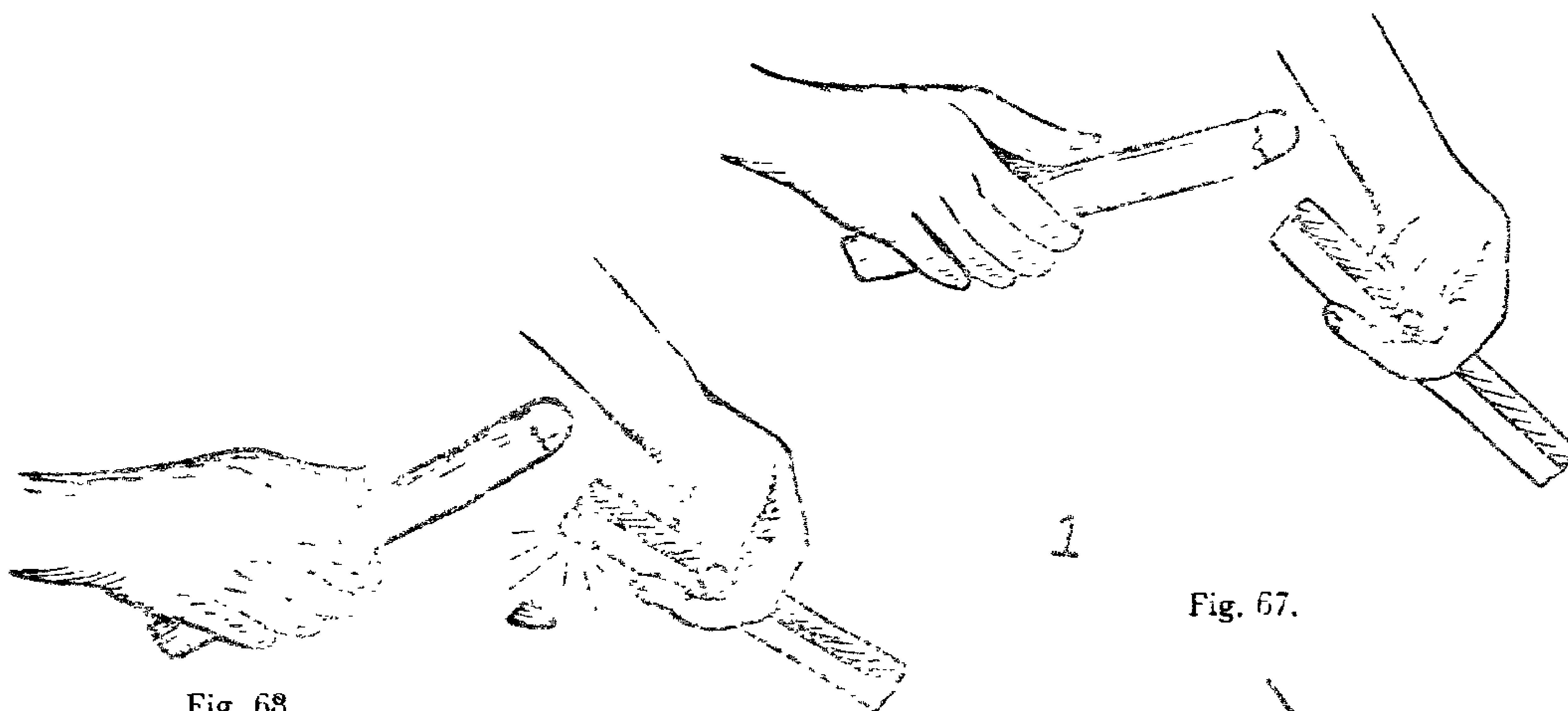


Fig. 67.

Fig. 68



Fig. 69

Fig. 67-69. Stages 1-3 in the preparation of a burin ***bec-de-flute***

with a view to removing a part of the sharp edges and to make a rough point (Figs. 68-69). Then the point is held lightly on the edge of an anvil stone with cutting edge vertical to the plane of the anvil stone (Fig. 70). A sharp tap is then given to the edge of the flake, thereby causing the tip of the blade resting on the anvil to receive the force of the blow by ricochet. Provided that the tip is held at the correct angle on the anvil, this causes a long narrow flake to be removed from the upper edge of the blade. By

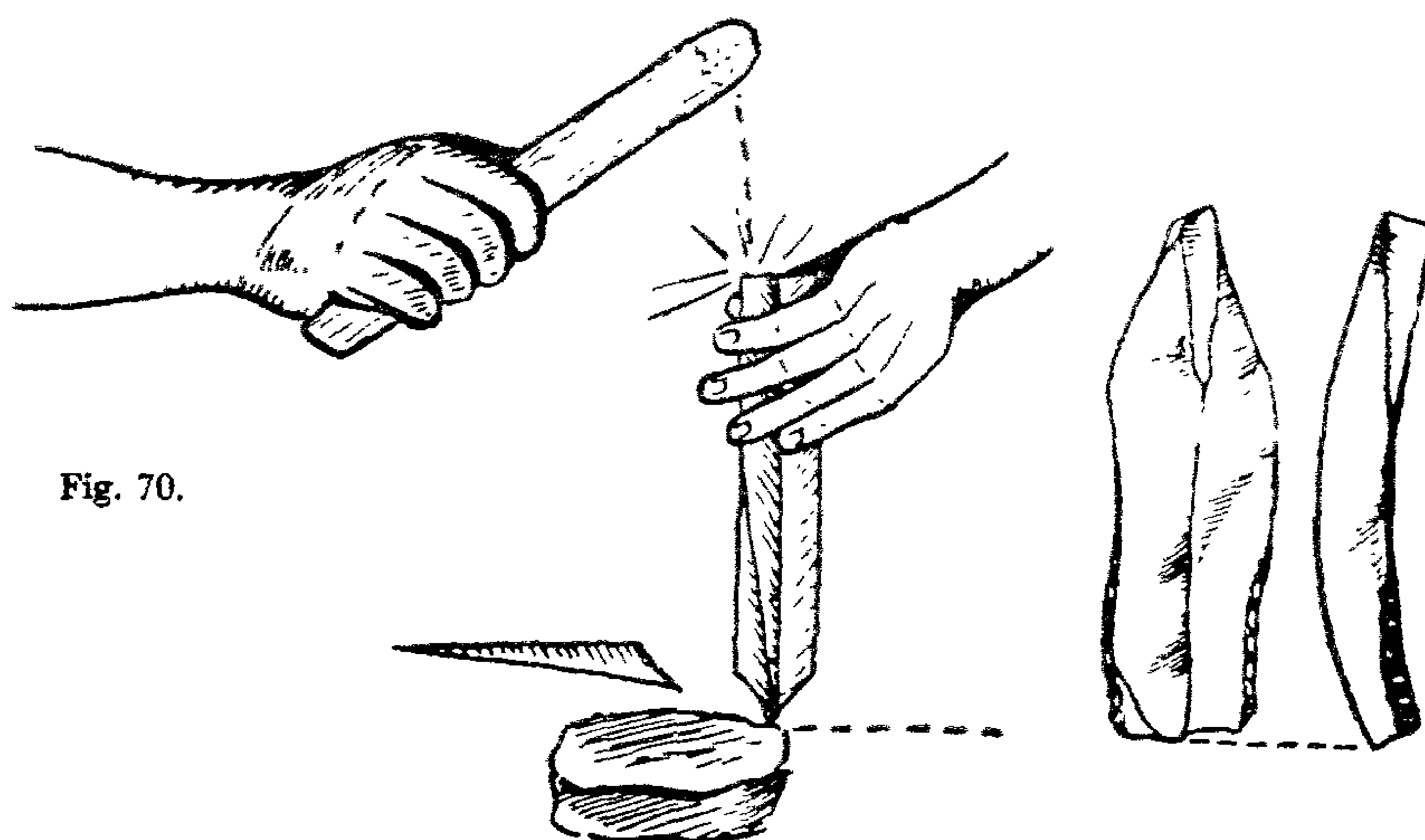
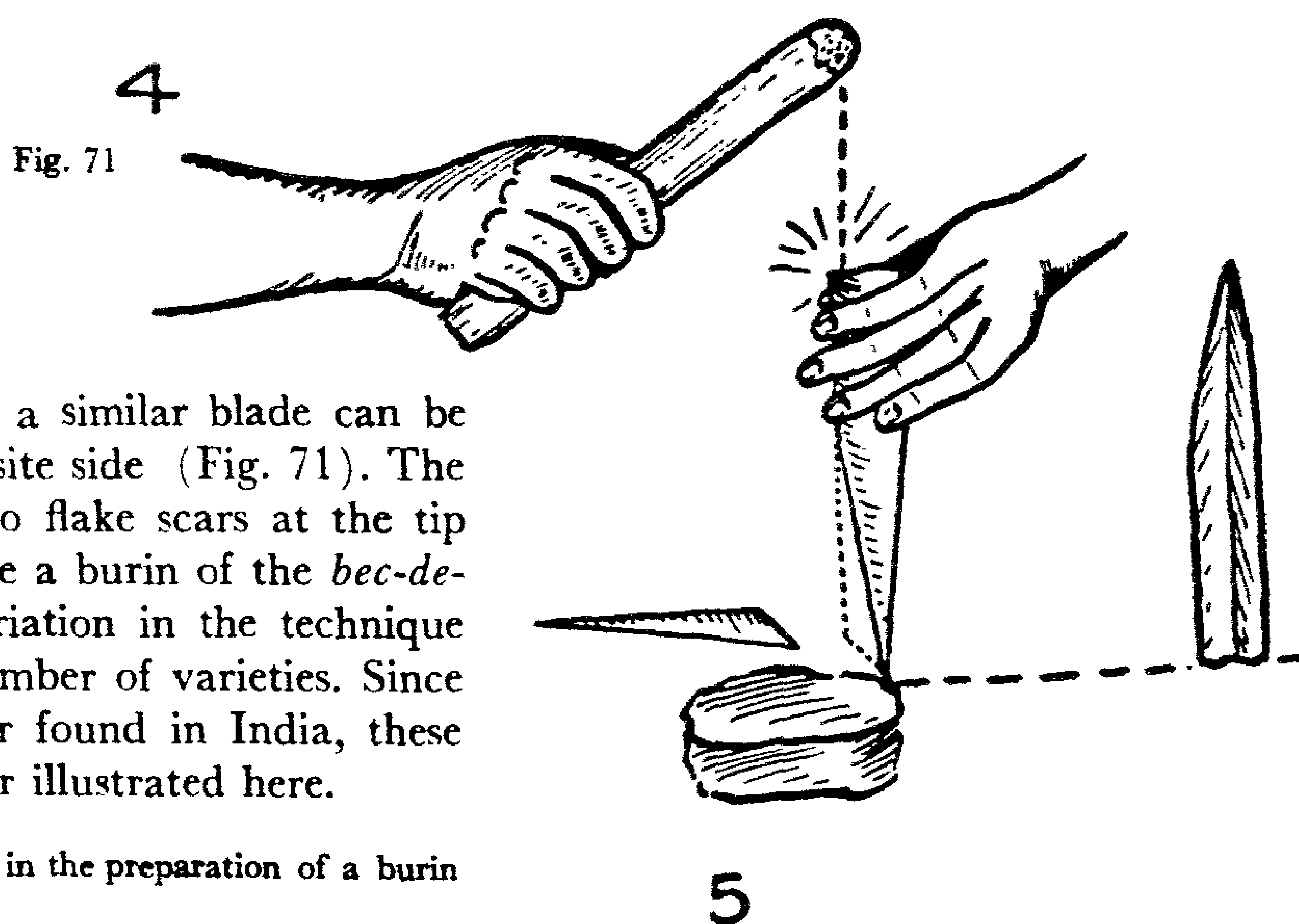


Fig. 70.

4

Fig. 71



5

turning the blade over, a similar blade can be removed from the opposite side (Fig. 71). The intersection of these two flake scars at the tip of the flake will produce a burin of the *bec-de-flute*" type.[1] Minor variation in the technique helped to produce a number of varieties. Since none of these are so far found in India, these are neither described nor illustrated here.

Figs. 70-71. Stages 4 and 5 in the preparation of a burin *bec-de-flute*

1. CLARK, J.G.D., 1932, *Mesolithic Age in Britain.*

Tools of the Late Stone Age

Microliths dominate the Late Stone Age and it is possible that these have been derived genetically from the Middle Stone Age tool types, though, so far no site in India has yielded any stratigraphical evidence to say so categorically.

Microliths

"Microlith" means 'small stone'. In practice and by convention, however, only those tiny stones are called "microliths" which are intentionally made into tools by "retouch" or "secondary work". Thus, every tiny core or flake is not necessarily a "microlith". "Strictly, the term is applicable to 'narrow' small flakes which are blunted on one or both edges by steep, secondary chipping, but devoid of secondary work on either face".

Use

It has been noticed that such microliths began to be used as tools in the Upper Palaeolithic period in Europe, Palestine and North Africa. Unlike the earliest tools, these were not used in the naked, bare hand, but hafted in a bone, wood or even clay handle. Secondly, the flakes or blades on which these microliths were made had been removed from the core by "pressure technique". Thus normally in countries where the history of civilization goes back to a remote past, "microliths" occupy a particular stage—chronological and cultural. But this is not so everywhere. For instance, in some parts of India, microliths are said to have been in use until the 10th century A.D., whereas they were still used for hunting etc. in Australia until the last century. In such countries, a surface collection of microliths has not much chronological and cultural significance. Some idea of the age can only be had, if the microliths are found in a layer, the age of which can be geologically or otherwise determined.

Types

Microliths are of various types. These types are determined according to the deliberate shape given to them by man while fashioning them further by trimming the edges by retouch. Most important and recurrent types are here described.

Cores

First we have the various types of cores. How these are made has been described above (p.39, Figs. 25-31). But besides these

types, a site like Langhnaj in Northern Gujarat may also yield cruder, amorphous cores.

Blades

Since the Upper Palaeolithic times in Europe, and Western Asia (Palestine, Syria etc.) man had begun to make use of thin, slender flakes. These, as pointed out above, are called blades. Not only such blades were obtained from certain kinds of cores in a particular manner, but after removal they were further trimmed or treated in various ways so as to yield different kinds of tools. The most common are blades with parallel sides and either with one mid-ridge (Fig. 72, i) or two parallel ridges (Fig. 72, ii). How these were obtained—by pressure flaking or by direct precussion—has been described in detail earlier (p. 38)

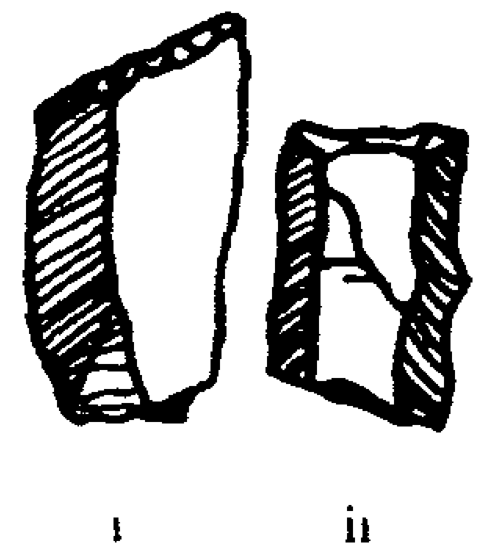


Fig. 72. Parallel side Blade with (a) one mid ridge (b) two ridges 1:1

Types

In a true Mesolithic culture such blades are often retouched, either on one longer side or on both the longer sides. In fact, this retouch is the *only test* by which we can distinguish a true blade from a large number of chips. These retouched blades are of three or four types: (i) single straight-sided; (ii) double straight-sided: (iii) straight but pointed at one end; (iv) straight with one end curved (as in a penknife) blade (Figs. 73, i, ii, iii,).

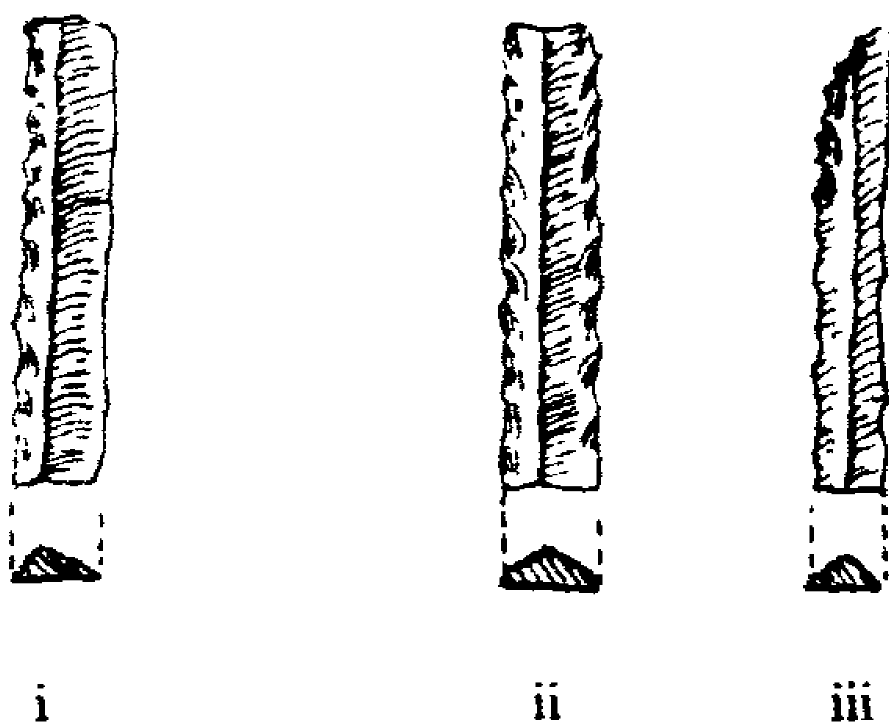


Fig. 73. Single Straight-sided Blade 1:1

(i) *Single straight-sided blade* is one where one of the lateral sides—usually the thicker backside—is steeply or obliquely blunted to facilitate hafting, whereas the other forms the cutting edge.

(ii) *Double straight-sided blade* is one where both the lateral edges are retouched for cutting purposes.

(iii) *Straight with one end pointed.* It is also called asymmetrical point. The back as in (i) is retouched, but gradually one end tapers to a point. Such a blade may be

compared with the so-called "Gravette Point" of the European Upper Palaeolithic.

(iv) *Obliquely blunted or Penknife blade.* (Fig. 73A) In this the backside is straight for half or more of the length, and then gradually or suddenly tapers into a point. The back is partly or fully retouched. Since such a blade resembles our present penknife blades, it is often described as such.

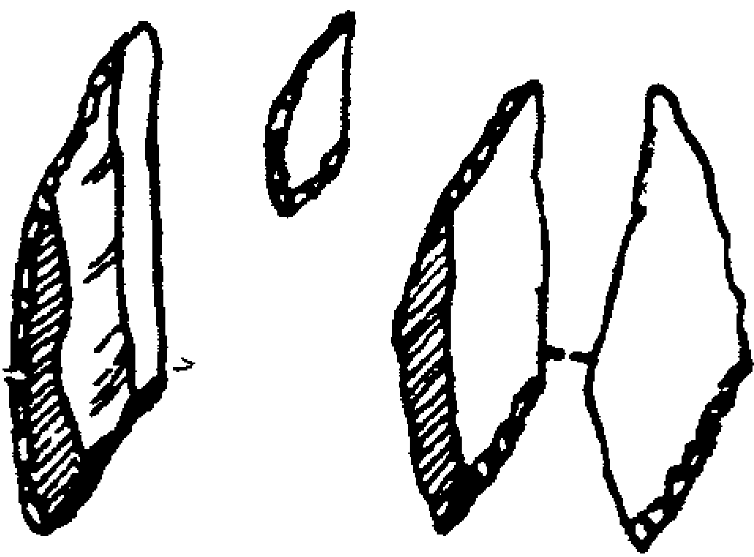


Fig. 73A. Obliquely blunted Point or Penknife Blade 1 : 1

Geometric and Non-Geometric Microliths

It is also customary to classify microlithic industries into "Geometric" and "Non-Geometric". The former include such geometric forms as "triangle" "crescent" and "trapeze". Such *regular* geometric forms are absent in non-geometric industry.

In European literature on the subject, the latter is also designated as "broad blade industry" and the former "narrow blade industry". Such geometric tools are believed to be later, because in France, England and in a number of European countries, as well as in Africa, such geometric microliths were stratigraphically separated from the non-geometric. No clear stratigraphic and exhaustive evidence is yet available from India.[1]

Lunate or Crescent (Fig. 74)



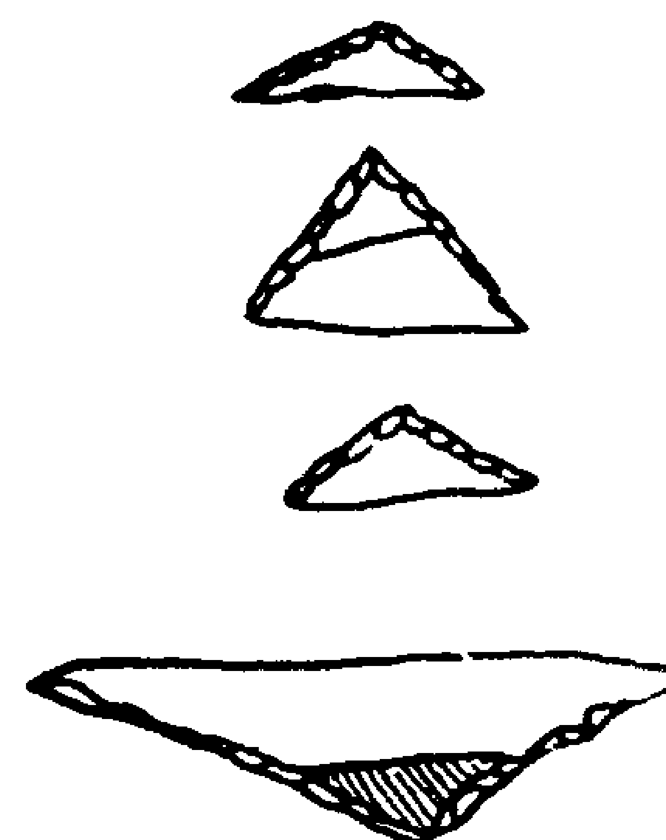
Fig. 74. Lunate. Above: with the chord and the arch retouched. Below: with only the arch retouched 1 : 1

These are tiny microliths which have the shape of a crescent moon. Usually the arc (round back) is thick and intentionally blunted to facilitate hafting in a handle. Very rarely, the chord (the straight opposite side) is also retouched. In the caves at Mt. Carmel in Palestine, Dr. GARROD found lunates in the Natufian layer[2] which are retouched from both the surfaces on the arc. (Fig. 35). The latter ends in a ridge, and is a very rare feature. Formerly such a kind of retouch was described by GARROD as "Heluan retouch", but after Neuville it is now called "*dos d'ane* retouch" or "ridge-back retouch". Crescents with only the arch retouched are more common. Even very minute forms are made with precision. It is often difficult to distinguish a lunate from a scalene triangle, for various transitional forms exist.

It is said[3] that a true lunate is symmetrical along the shorter axis, and hence is different from the crescent which may be pointed

1. Shri Radhakant VARMA's excavation in a rock-shelter in Mirazapur, Uttar Pradesh is believed to have given such an evidence.
2. GARROD, D.A.E., (1957), *The Natufian Culture: The Life and Economy of a Mesolithic People in the Near East,* p. 215.
3. There are rare cases in which the chord or the straight edge as well as the arc are retouched.

at one of the ends and hence asymmetrical. This distinction is justified when a lunate is compared with a crescentic point. However, there are specimens which are absolutely symmetrical with both their ends pointed like a crescent, while in others the ends are not pointed.


Fig. 75. Regular and Irregular Triangle 1 : 1

Triangle (Fig. 75)

Two main varieties are distinguished.[1]

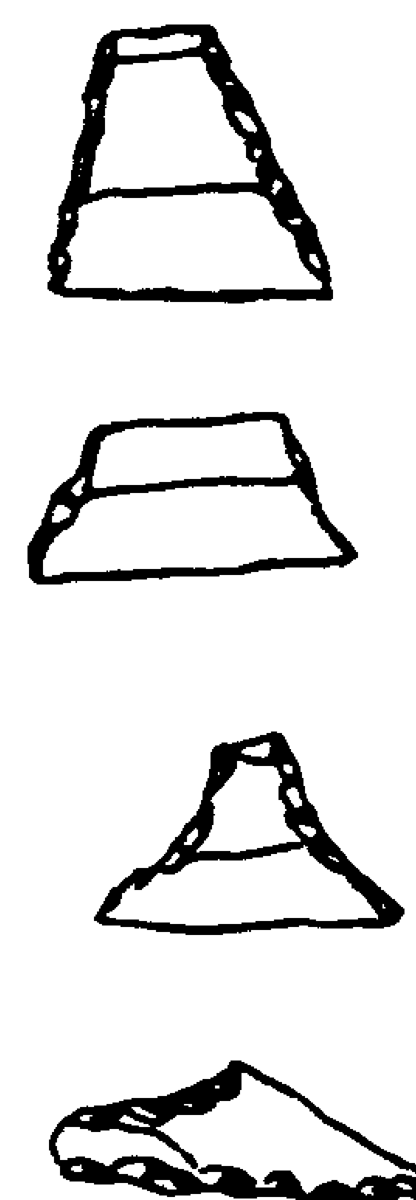
(a) Non-geometric form, approximating a triangular form.

(b) Neatly formed regular form such as scalene, equilateral and iscoceles triangle.

In both, as per definition given above, the two longitudinal sides are steeply blunted.

Trapeze (Fig. 76)

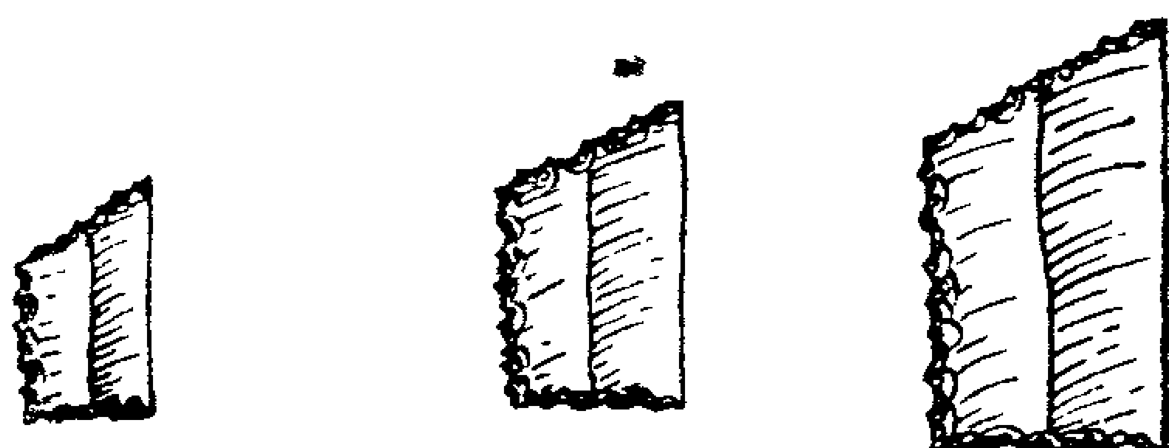
In a trapeze, the two horizontal (upper and lower) sides are parallel and the shorter ones are not. In a true microlithic trapeze, these parallel sides consist of the original primary flake of which the tool is a part. These sides are left unretouched, whereas the non-parallel sides are blunted by steep retouch. These are sometimes straight and sometimes concave and also longer or shorter than the parallel sides. Thus several sub-varieties of trapezes are possible. Four are here illustrated after CLARK.[2]


Fig. 76. Four types of Trapeze 1 : 1

In Europe, trapezes belong to the later half of the Mesolithic. No such precise dating has yet been made in India.

Trapezoid (Fig. 77)

CLARK defines a trapezoid as a quadrilateral figure, having no pair of sides parallel in contradistinction to the trapeze.[3] When two


Fig. 77. Trapezoid 1 : 1

1. LAL, B. B., in *Ancient India*, No. 14 (1958), p. 19.
2. CLARK, *op. cit.*, p. xxiiii.
3. *Ibid.*, p. xxiii.

sides of such a microlithic form are found blunted, it is called a trapezoid. In some varieties, we have a right-angled form which may be (i) square or (ii) elongated.

Triangular Form (*Not illustrated*)

This is a fairly common type. It is roughly triangular in form, but the base is truncated.

Penknife Point (Fig. 73A)

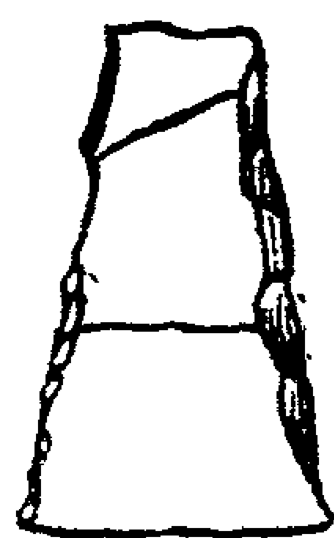


Fig. 78. Transverse Arrow-head 1 : 1

This is identical with obliquely blunted blade. In this tool-type, the straight edge is formed by the primary flake edge, while the convex or the arched edge is blunted. Further the basal end is also obliquely truncated by steep chipping.[1]

Within the last 10 years it has been found that the pen-knife blade figures prominently in the Chalcolithic Cultures of India.

Transverse Arrow-head (Fig. 78)

This tool-type belongs to the trapeze or trapezoid family.[2] Sometimes in literature on Indian microliths a trapeze-like form has been described as a "transverse arrow-head". A true transverse arrow-head is made on the section of a flake with steeply blunted sides. It is also sometimes called "*Petit tranchet*", i.e. small tranchet.

Tranchet (Not illustrated)

This is a term applied to tools of which the cutting edge is formed by the intersection or meeting of two or more flake scars. Thus in the case of (i) flake tools, before the flake is removed from the parent core, some flaking may have been done on the flaked surface; (ii) core tools, the edge may be renewed by a special blow struck transversely at one corner of the extremity.

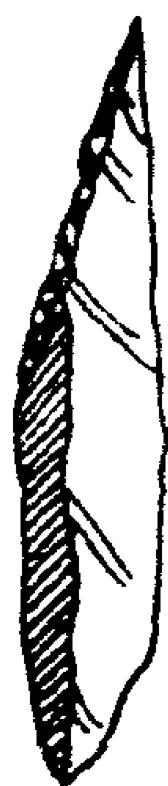


Fig. 79. Obliquely Blunted Point 1 : 1

Obliquely Blunted Point (Fig. 79)

This tool type is classed among the non-geometric group.[3] It is made on a narrow flake by oblique secondary retouch to a point. In a majority of cases, the blunting is found to be on the left edge.

Truncated Blade (Fig. 80)

An obliquely pointed blade superficially resembles a parallel-sided blade, which is sometimes (a) obliquely truncated, and

1. *Ibid.*, p. xxii.
2. *Ibid.*, p. xxi.
3. *Ibid.*, p. xx.

(b) transversely truncated. In any form of truncation, the blade may be split and not *intentionally retouched later;* whereas in truely obliquely blunted point, the retouch must be there.

This is a rare type and belongs to the geometric group and may have developed from any one of the above types. Among the several varieties, CLARK distinguishes two types:

(i) a narrow rhomboidal form with chipping on three or more sides;

(ii) with the tail or lower end thickened.

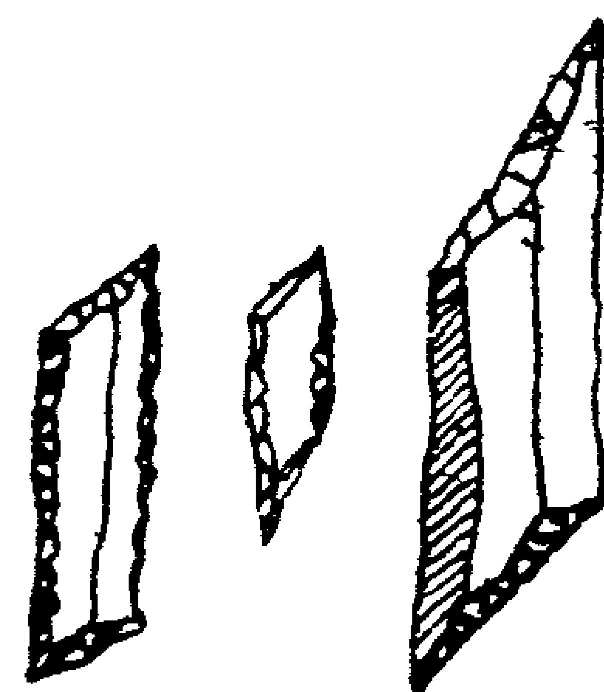


Fig. 80. Truncated Blades 1:1

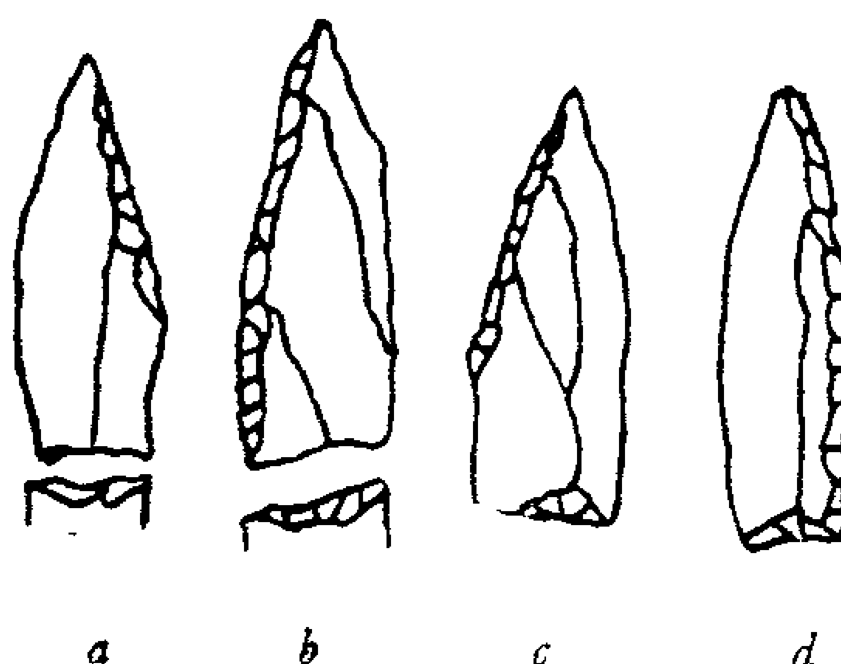
Hollow-based Point (Fig. 81)

These are tools in which at least a part of one side is steeply blunted and secondly the base is deliberately made hollow or concave by retouch. Two main forms are distinguished:

(i) Symmetric

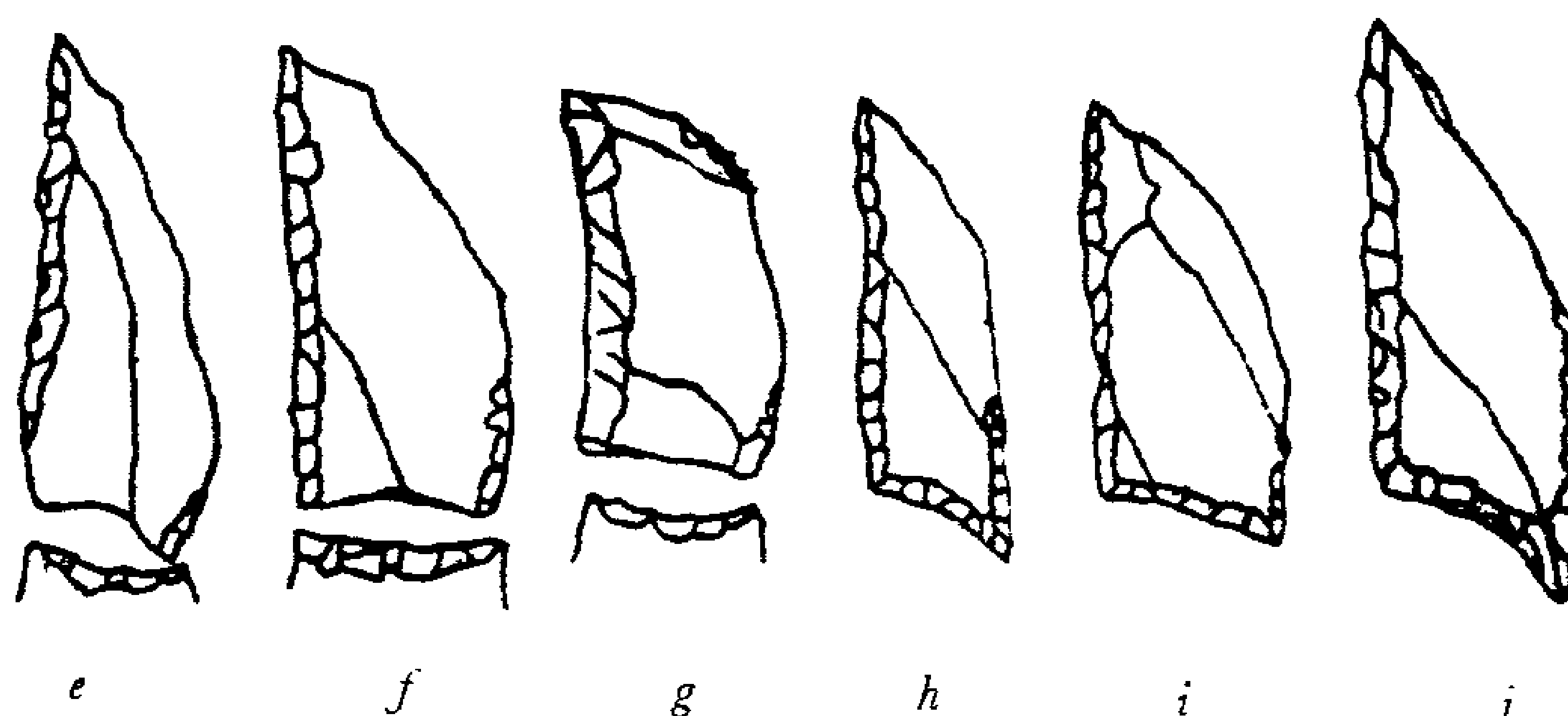
(ii) Asymmetric

Fig. 81. Symmetric Hollow-based Point 1:1



The symmetric is so called because it has a regular form like a triangle, (Fig. 81, *a-d*) while the other resembles the obliquely blunted point in having one side straight, the other oblique and the base hollow or concave. (Fig. 81, *e-j*). The former is regarded "more primitive". This form is very rare in India.

Fig. 81. Asymmetric Hollow-based Point 1 : 1



In both the main types, an evolutionary series may be worked out. Further, it is also noticed that in some the concave or hollow base is made by secondary retouch from the upper surface, while

in others it is from the under surface. Again the blunting on the side may be partial or full.

Core Trimming (Fig. 82)

This is a by-product which results wherever a long or short fluted core, from which shallow longitudinal (lengthwise) flakes have been removed, is not capable of yielding any more flakes. It becomes more and more conical. So such a core has to be prepared afresh.

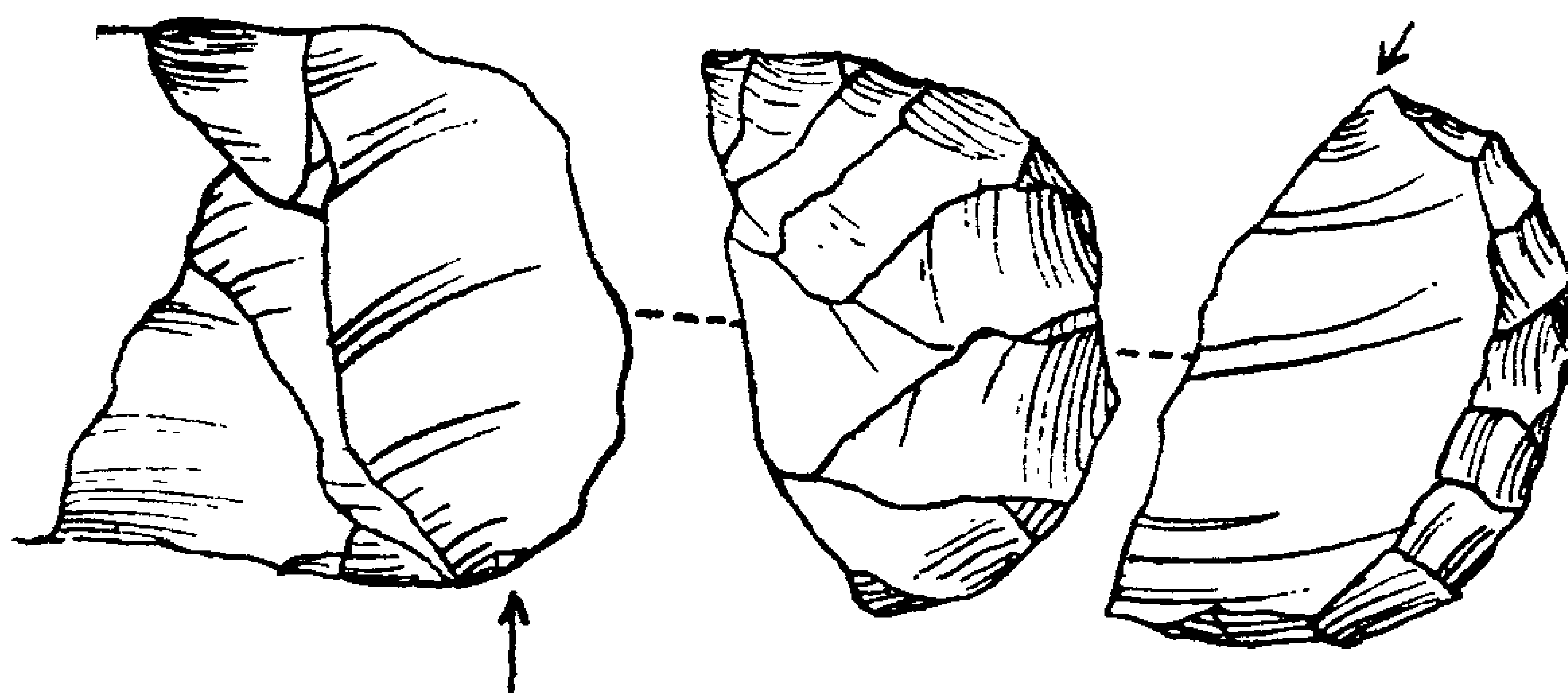


Fig. 82. Core Trimming 1 : 1

This is done by giving a blow a quarter or half an inch above it, (that is, the platform). Thus a disc-like thickish flake was removed from the above core. This is called "core-trimming". Its undersurface is the primary flake surface, while the upper is conical or convex with a battered keel. Thus it will have a triangular or plano-convex section.[1]

Micro-burin (Figs. 83-84)

This is one of the most controversial or disputed tool types in the microlithic industry. For, while some scholars regard it (i) as the result of an accident while *using* a piercing tool like an awl or a drill or a point, (ii) others think that it is a by-product which results while making a trapeze from a double-notched blade, (Fig. 83) and (iii) a third group regards it as a definite tool-type being prepared by a definite blow. The question was fully discussed by J. G. D. CLARK some 30 years ago but since then no additional facts have been adduced for any of the theories.

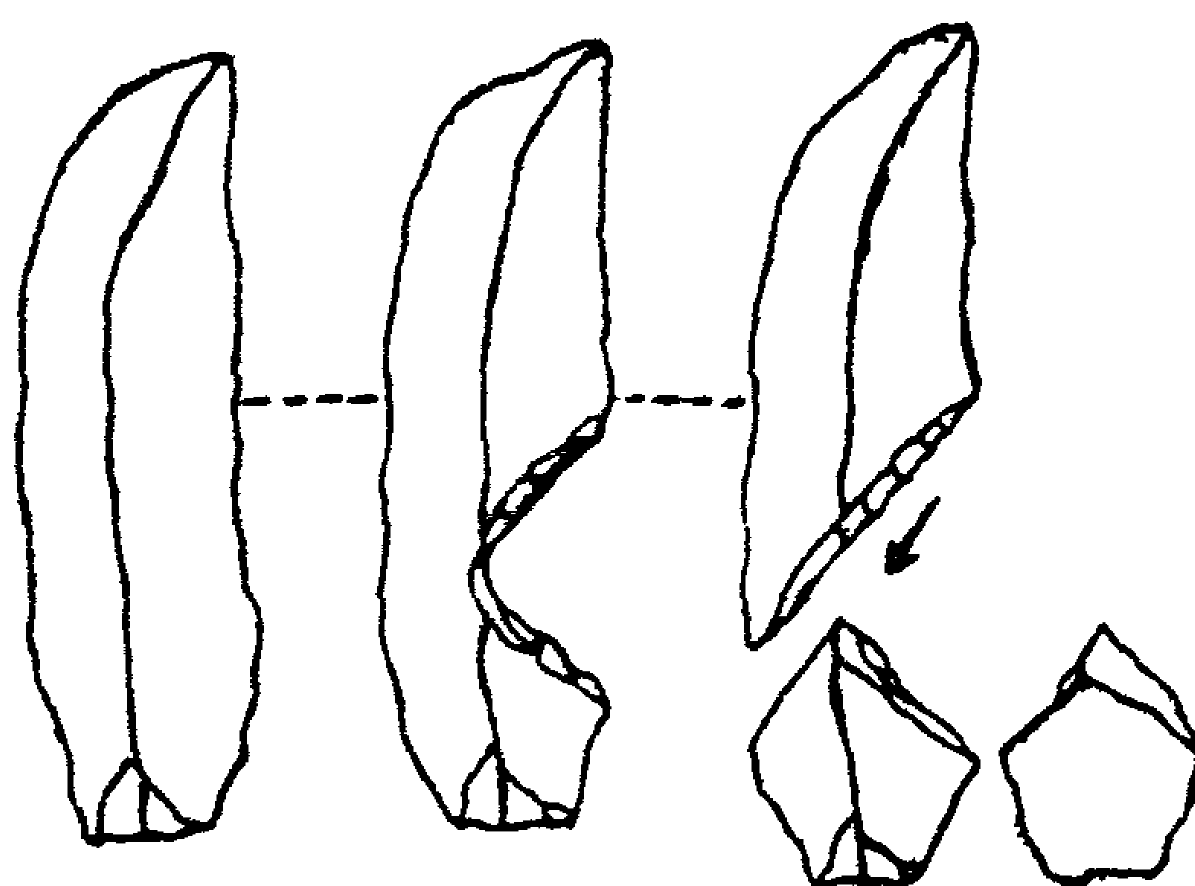
The micro-burin is sometimes regarded as a special form of a burin on a pointed blade (*burin sur lame appointee*). Its special

1 *PPSEA.*, IV, 67, Nos. 6-7 and CLARK, *op. cit.*, pp. xix-xxii.

feature is that it has a burin-like facet, almost in the same plane as the flake surface, and a notch from the under surface on the opposite side of the flake struck. (Fig. 84)

In simple words, the micro-burin is a flake or blade in which one side of the pointed end is the result of a vertical blow or action as in a true burin, whereas the other side is made by deliberate notch. And the main point of contention is about the former. whether it is accidental or intentional or a natural result of flaking for a particular purpose.

2



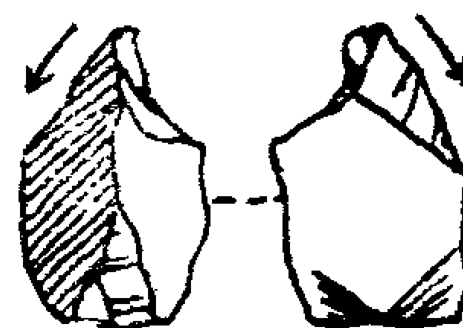


Fig 83 Double-notched Blade 1 : 1

Fig 84. Micro-burin 1 : 1

Whatever it is, "micro-burin" was regarded at one time as a characteristic feature of certain Mesolithic cultures in Western Europe, like the Tardenoisian of France. It occurs also, though rarely, in the Indian microlithic industries, but its exact chronological and cultural significance, if any, remains to be ascertained.

Scrapers

The next important group is formed by various kinds of scrapers.

So far no objective or purely geometrical names have been devised for these. Hence the literature on the subject abounds in such terms as "nose" scraper, "beak" scraper, "keel" scraper, "hollow and concave" scraper etc. Very often, as in the last, the same form is meant by both the names. In this welter of confusion created by a variety of terms, only a few basic forms are described. The

main emphasis is laid on the position and nature of the secondary retouch.

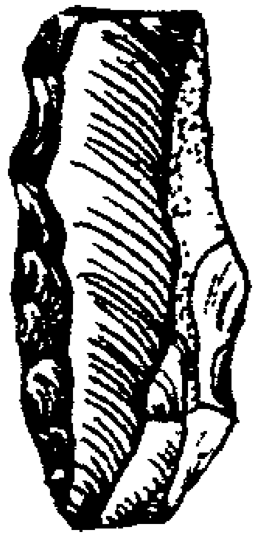


Fig. 85.
Side Scraper 1 : 1

Side Scraper (Fig. 85)

This is a tool usually made on a thin or thick flake, but occasionally on the core itself; the working edge is on the lateral or longer side, while the opposite side may be naturally thick and suitable for hand-hold or hafting, or it is intentionally prepared for this purpose. The retouch is normally from the upper surface, but may be from the under as well.

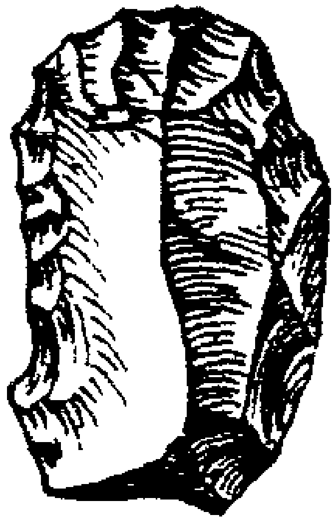


Fig. 86.
End Scraper 1 : 1

End Scraper (Fig 86)

It is a tool in which the shorter side is retouched thus forming the working or business end.

Steep Ended Scraper (Fig. 87)

It is really an "End Scraper", the main emphasis being paid to the form, the side being steep and its edge at the base is retouched for use.

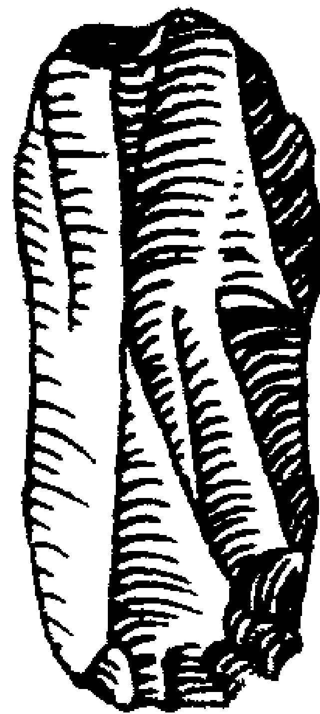


Fig. 87 Steep ended Scraper 1 · 1



Fig 88.
Hollow or Concave Scraper 1 · 1

Hollow or Concave Scraper (Fig. 88)

This may be on a thin or thick flake or rarely on the core itself: the distinctive feature is that one or two sides of the specimen are hollowed out by removing a large flake or these are naturally so, and then are further retouched.

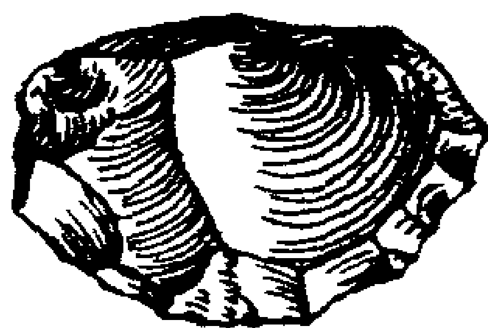


Fig. 89.
Convex Scraper 1 : 1

Convex Scraper (Fig. 89)

As opposed to the concave-sided scraper, the side in this kind of scraper is slightly rounded or convex, and further retouched.

Tools of the Neolithic (or New Stone) Age

Grinding and Polishing

In all the methods of flaking so far described, the finished tools, though shapely and showing gradual improvement, had their surfaces comparatively coarse and uneven, being manufactured only by one technique, viz. flaking or chipping. If we were to take an analogy from our modern life, such coarse-surfaced tools or piece of furniture would be popularly described as "unpolished" or not smooth. This exactly describes the new technique which appears at a certain stage in the evolution of the Stone Age tools. The processes by which the surfaces were smoothed and sometimes made glistening so as to reflect light are called "grinding and polishing". It is not known where exactly and how they were invented.

COGHLAN[1] has postulated several stages. According to him, it might have developed from a palaeolithic sharp-edged scraper. A lighter variety of a ground axe is already associated with the Solutrean and other Upper Palaeolithic cultures of Western Europe, whereas in the Danish kitchen middens a rounded pebble has been converted into an axe with minimum of grinding.

There is no doubt that its origin is intimately related to the raw material and a forested environment. Very fine-grained igneous rocks—such as dyke basalt, dolerite and epidiorite (greenstone)—were preferred to the former quartzite and flint. Though there are instances when metamorphic rocks such as quartzite, schist and gneiss, as also softer rocks like sandstone and limestone are used. Jasper and chert were out of the question because it was difficult to get large blocks of these rocks, though these might also be employed very occasionally. Hence man preferred to stay near places where dykes of basalt etc. were available. The availability of raw material was always the prime consideration. Here too very rarely an attempt was made to quarry the material directly from the dyke.

Usually most suitable nodules and pebbles and chips were chosen so that without much effort a sharp-edged tool, or a thick-sided axe with a bevelled or sloping edge of the requisite size and shape could be produced. As FOOTE had long ago observed specimens of rough material were sought, which were so shaped by the existence of joint planes as to approximate to the forms the people desired to produce. It is therefore possible that the availability of suitable raw material gave rise to "factory" sites from which the finished tools were exported. Grand Pressigny in France, and Bellary in Andhra-Karnatak are some of the most well-known Neolithic

1. COGHLAN, H. H., "Evolution of the Axe", *JRAI.*, LXXIII, p. 34 ff.

factories. Trade with distant regions can be traced to this period. It is therefore possible to group the Neolithic tools in India according to the raw material. There are two main groups: (1) South-Eastern and (2) Eastern. In the former, the most common material is dolerite, basalt and archean schist, and occasionally gneiss, diorite, and porphyritic trap. In the latter, which comprises the whole of Assam. six sub-groups are recognized. From west to north-east in the Garo Hills which form a part of the Shillong plateau and the adjoining Brahmaputra Valley the material is mainly sandstone, but in the former, at times black basalt, limestone and chert are found to be used. In the Cachar Hills dolerite and a kind of clayey material; whereas further up in the Naga Hills, the material is a greenish variety of gneiss and dolerite and to a small extent jadeite. The latter is the main material in Sadiya Frontier Zone bordering Yunnan Province of China. In Bihar and Orissa areas which form a part of the Chota Nagpur plateau the material is usually of igneous origin.

Grinding

When the original pebble or nodule is of a soft material, like sandstone, and its shape very much resembles the tool man wanted to fashion, not much further work was necessary. The pebble or nodule was carefully ground to have smooth surfaces and a sharp cutting edge. This was the most essential feature of the group of tools formed by the axe, adze, wedge and chisel.

But in all other cases, the tool goes through three or four processes or stages,[2] before it finally appears as a finished ground or polished tool.

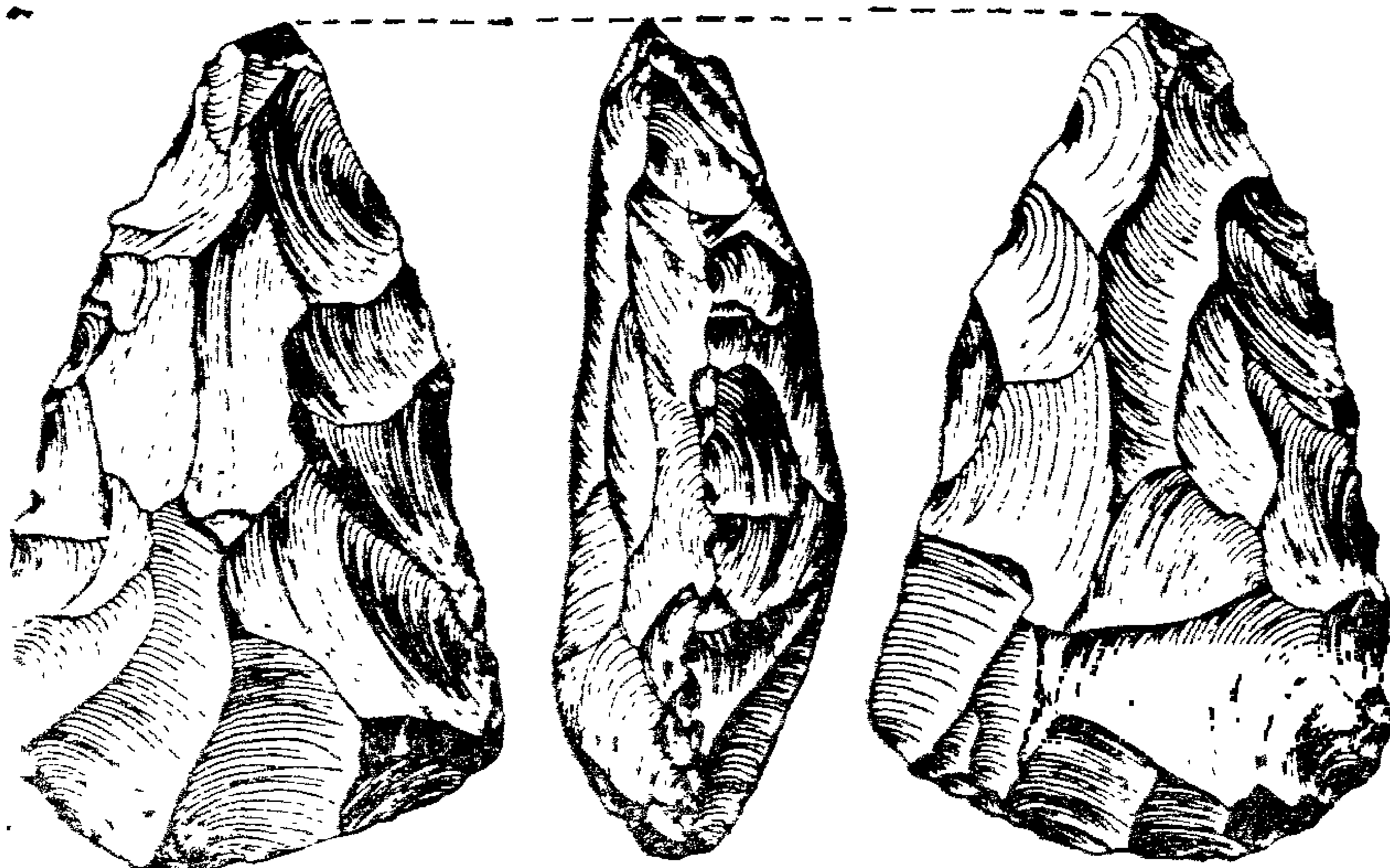


Fig. 90. Preparation of a Ground axe, 1st stage 1 : 2

1. See ALLCHIN, F. R., "The Neolithic Stone Industry of the North Karnatak Region", *BSOAS.*, Vol. XIX, 1957, pp. 321-35.

2. ALLCHIN "Piklihal Excavations" *Andhra Pradesh Government Archaeological Series, No.* v, (Hyderabad 1960) p. 86, postulatas the following five stages:
   i. Primary—rough flaking to block out the tool.
   ii. Secondary—fine flaking to regularise the form and sharpen the edge.
   iii. Pecking or hammer dressing.
   iv. Edge grinding.
   v. Overall grinding.

First Stage (Fig. 90)

A pebble or nodule or any fine grained rock is fashioned roughly into the desired shape of the tool, say pointed-butt axe. This is done by block-on-block technique or direct percussion method with a spheroid or discoid hand-hammer and the resultant product looks like an Abbevillian handaxe.

Second Stage (Fig. 91)

Such a free-flaked form has naturally many uneven surfaces—ridges and depressions. So with a pointed tool, these ridges are next removed, and an attempt made to have an even surface. This is technically called "pecking" (also battering or hammering). ALLCHIN says that this was done with a small cylindrical or discoid hand hammer.

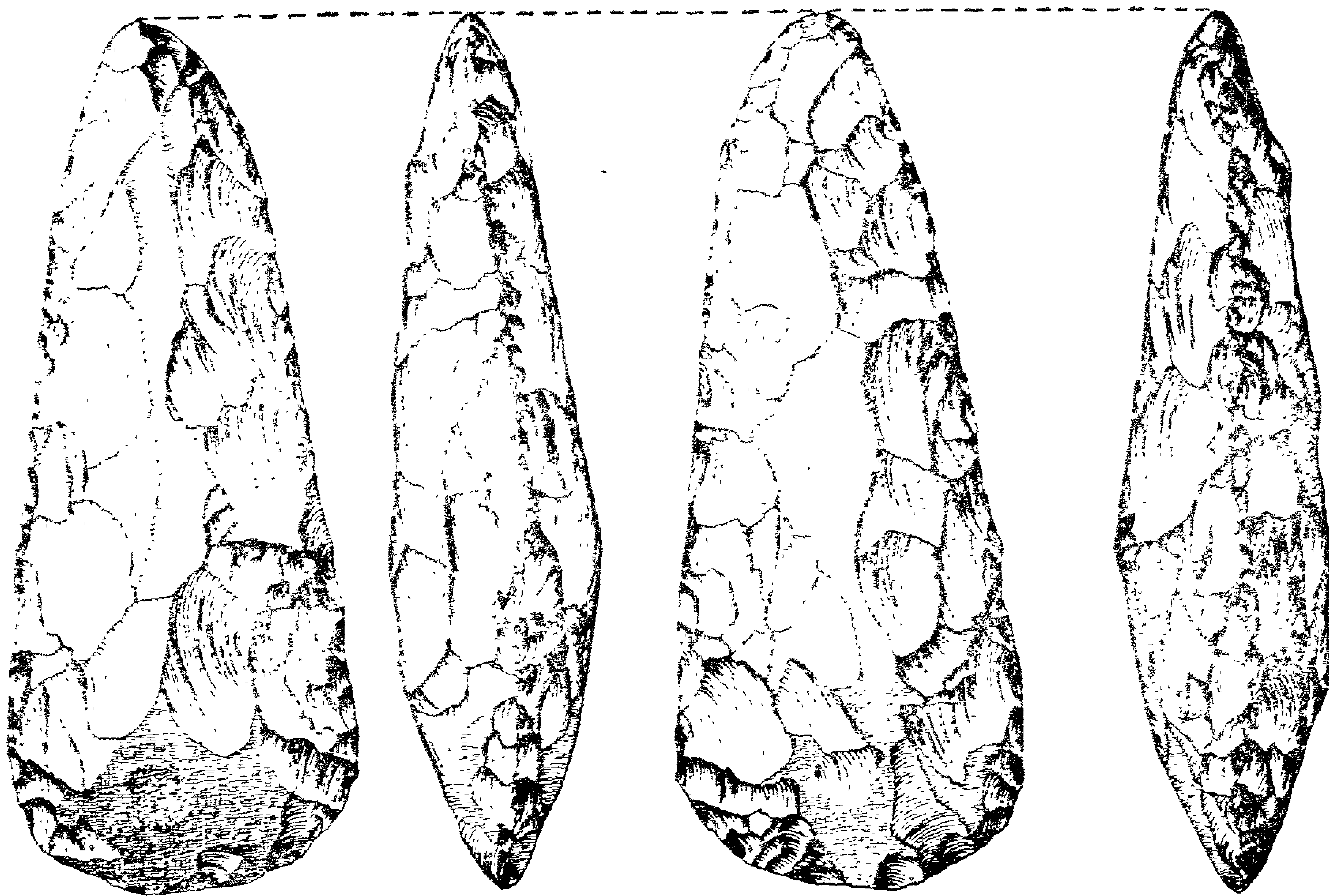
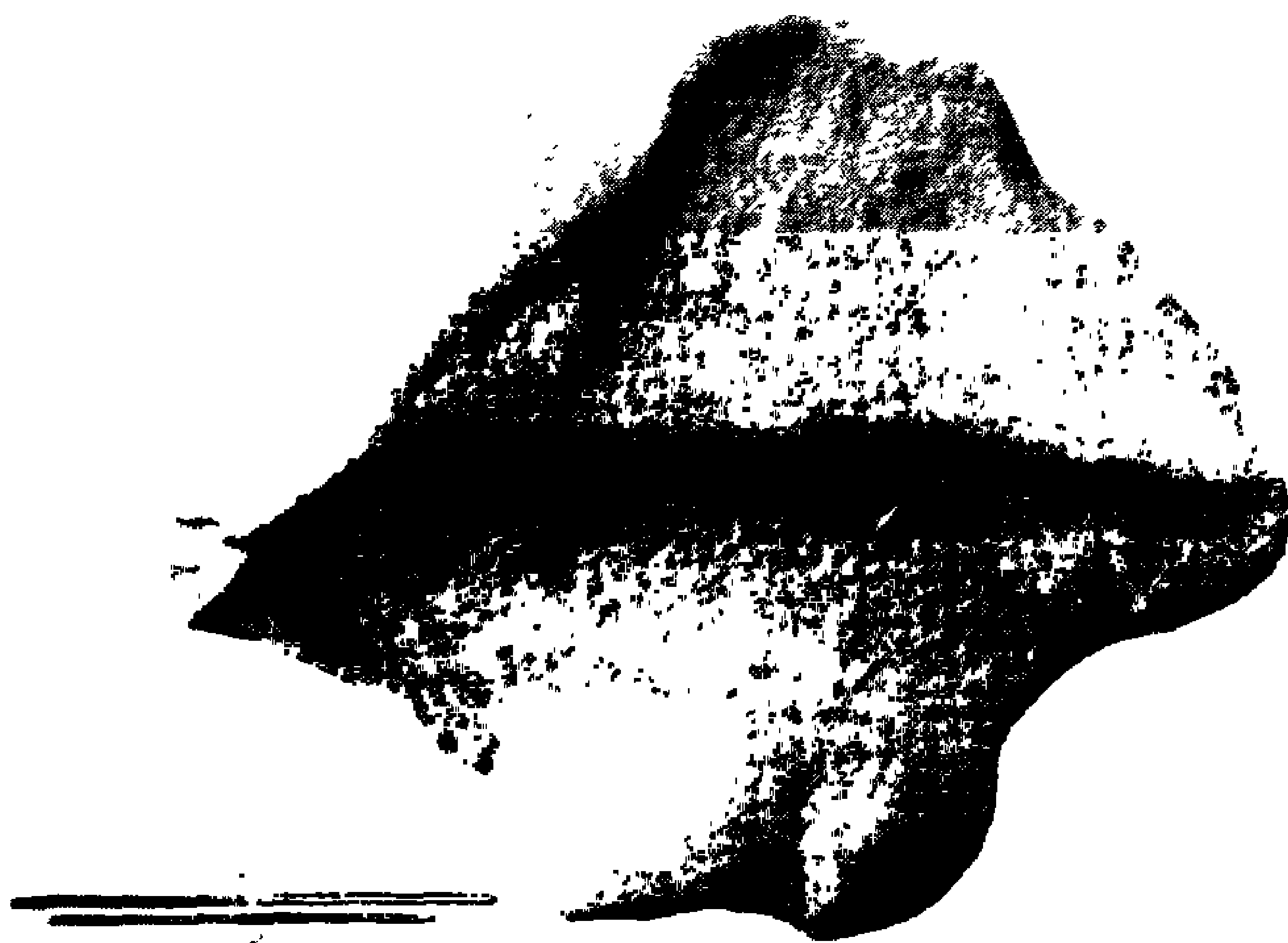


Fig. 91. Preparation of a Ground axe, 2nd stage 1 : 2



Fig. 92. Grinding grooves, Sangankallu, Bellary, Mysore State.





See p. 93.

Fig. 93. Convex-edged Stone tool with a prepared tang from Dongargaon, Dist: Hoshangabad, M.P.

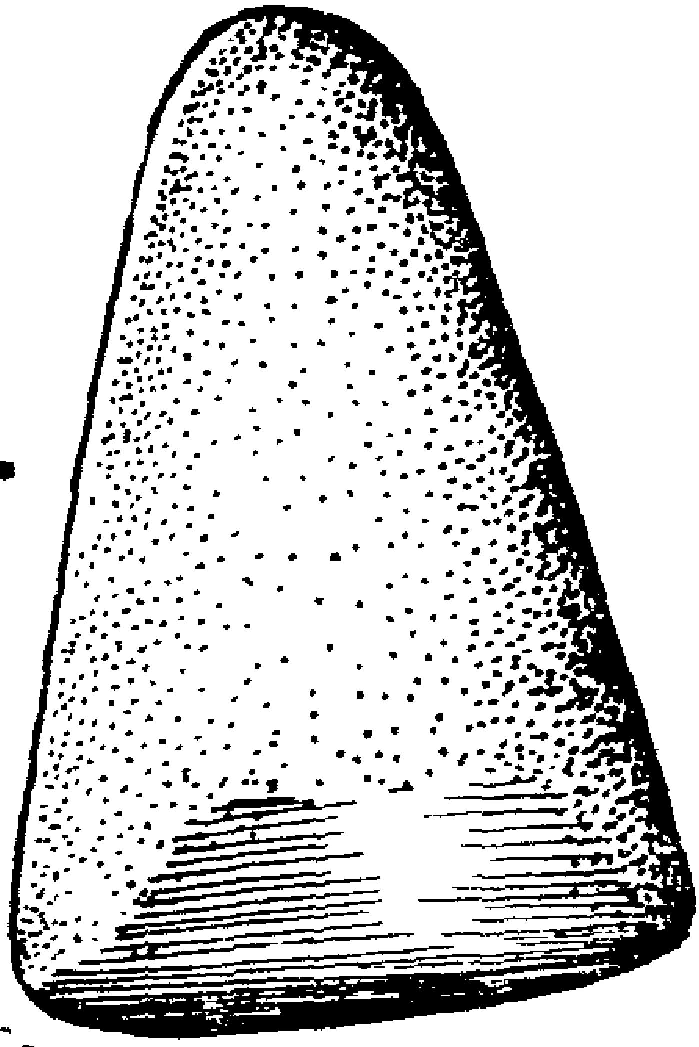


Fig. 94. Third stage. Pointed buttaxe with the edge ground 1:2

Third Stage

Now the tool is ready for grinding. For this large concave or basin-shaped boulders[2] (Fig. 92-93) or stones are chosen and with the help of sand or similar coarse material and a little water serving as abrasive, the tool is moved up and down in the groove. The smooth surfaces on the available tool as well as the grooved boulders definitly indicate that at a time only a *small portion of the tool was ground.* This was usually the edge portion. (Fig. 94)

This is a time-consuming process and it has been reported that the primitives in New Guinea took nearly three months to produce (a fully?) ground or polished tool. The process is exactly as today when a barber or a smith wants to sharpen the edge of a razor or any other steel tool. Only he works for a minute or so, while the grinding of a stone axe takes a longer time. The details are as under:

> "It takes almost three months of constant toil to make a good stone axe, and another week to make a complete stock and handle for it. Day after day, one of those old-time craftsmen will sit by a puddle of water, grinding the stone upon a big, well-worn sandstone. The blade scrapes forward, turns slightly in the grinder's hand, clacks against the stone, then scrapes back its other edge with hollow, grating sound".

Consequently in any collection one finds only a few fully ground tools. (See p. 106)

Fourth Stage: Polishing (Fig. 95)

Usually many writers recognize only the first three stages. Polishing is not regarded as a separate stage, nor are the tools called by this term. But, the writer thinks we have got to provide a term for distinguishing highly ground tools with shining surfaces or surfaces which reflect light from tools which have undergone only limited grinding. Normally, in our daily

1. FOOTE, *op. cit.*, pp. 117 and 129, cites two such polishing grooves on Kappatralla hill in Pattikonda taluq and on a low rocky hill at Poollyooda in Kurnool District. One is illustrated by SUBBARAO from Sangankallu. (Fig. 92) The writer saw one at Bilgi Petha in Dharwar District. ALLCHIN cites some from Raichur. A portable one was found by him at Sangankallu.

[1]Thomas GALLARD, "New Guinea's....... Stone Age Man", in *National Geographic,* CIII (1953), pp. 486-87.

life we call objects—shoes, pottery or brass as "polished". This is due no doubt to (i) intense rubbing, and (ii) application of such material as "polish"—any kind of grease or oily substance—over the smoother surfaces prior to the final rubbing. We do not know whether such a thing was used in the preparation of tools with shining surfaces. But a term like "polishing" alone conveys the meaning or the full significance of such a product and hence its retention. Normally, however, for describing the industry the term "Grinding" or "Ground Stone Industry" is sufficient and appropriate.

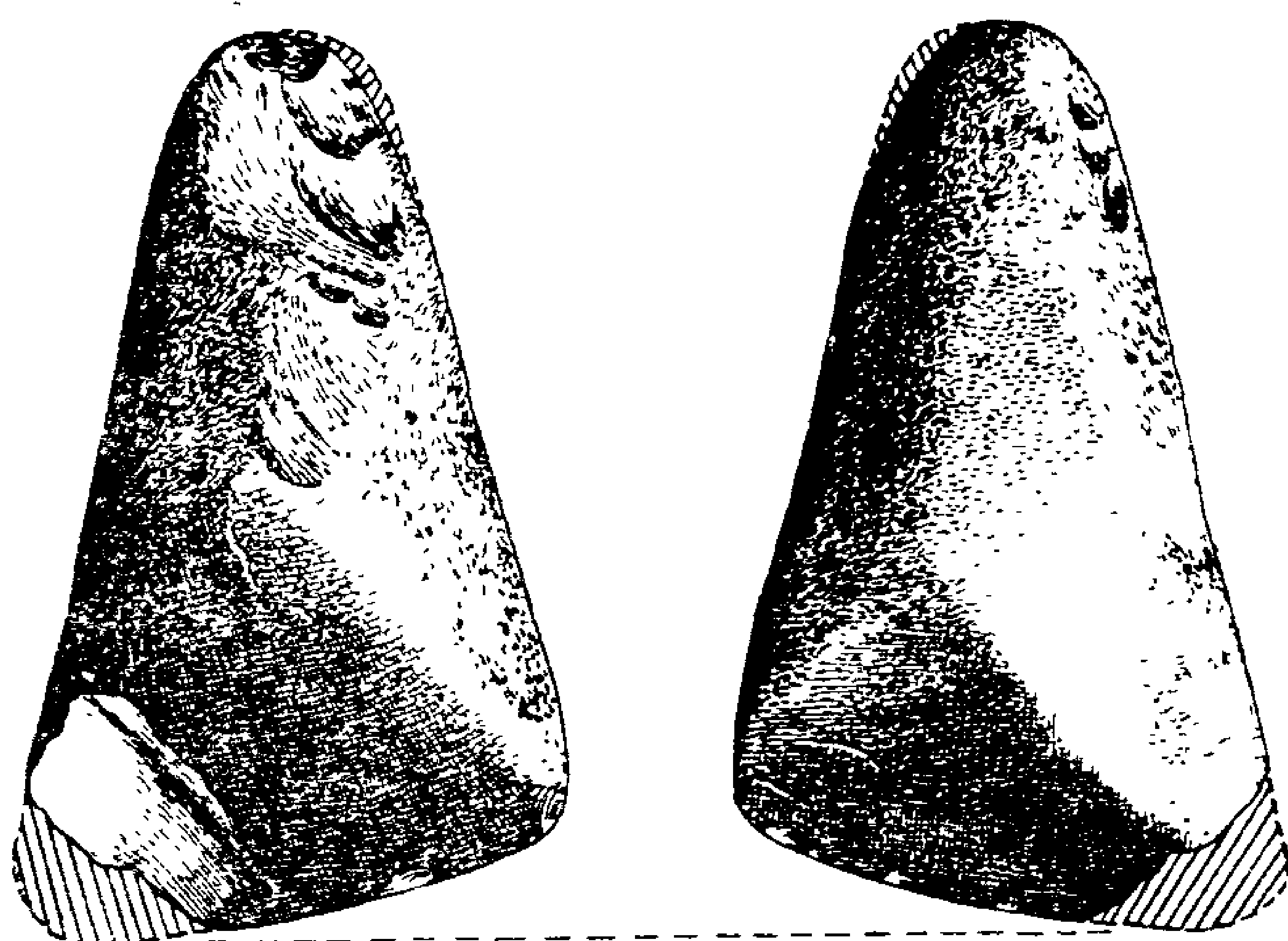


Fig. 93. 4th stage, Fully ground or polished axe with a corner broken 1:2

Tool Types

The tools of most common occurrence in the Ground Stone Industry are:

(i) Celts or axes, with (a) pointed, (b) square or rectangular and (c) rounded butt, and bevelled edges;

(ii) Chisels with (a) square or (b) rectangular or (c) rounded section.

(iii) Adze.

(iv) Fabricators or small cylindrical punches.

(v) Hammerstone (a) round (b) squarish (c) plano-convex.

(vi) Rubber Stones and Saddle Querns.

(vii) Ring Stones, round, but at times rectangular.

All these stone tools not only indicate the new techniques of preparation of the tool, but the new mode of life of the man who made them. For we certainly know that the axes, adzes, and the ring-stones were hafted in various ways. And with their help man took the first steps in agriculture, carpentry, mining and quarrying. The axe, adze and chisel were primarily used on timber. Their origin, it is rightly believed, must have been in a forested region which need not have been only one, but two or several. These have been discussed at some length by COGHLAN[1]. Thus not only these tools are the direct forerunners or prototypes of our metal tools, but they paved the way for the next stage of man's material advance, *viz.* metallurgy.

Celt or Ground or Polished Axe (Fig. 95A)

The first name, celt, is believed to be founded on a false reading in a vulgate (popular reading) and was applied to a stone, bronze or iron chisel-ended prehistoric implement, while the two latter

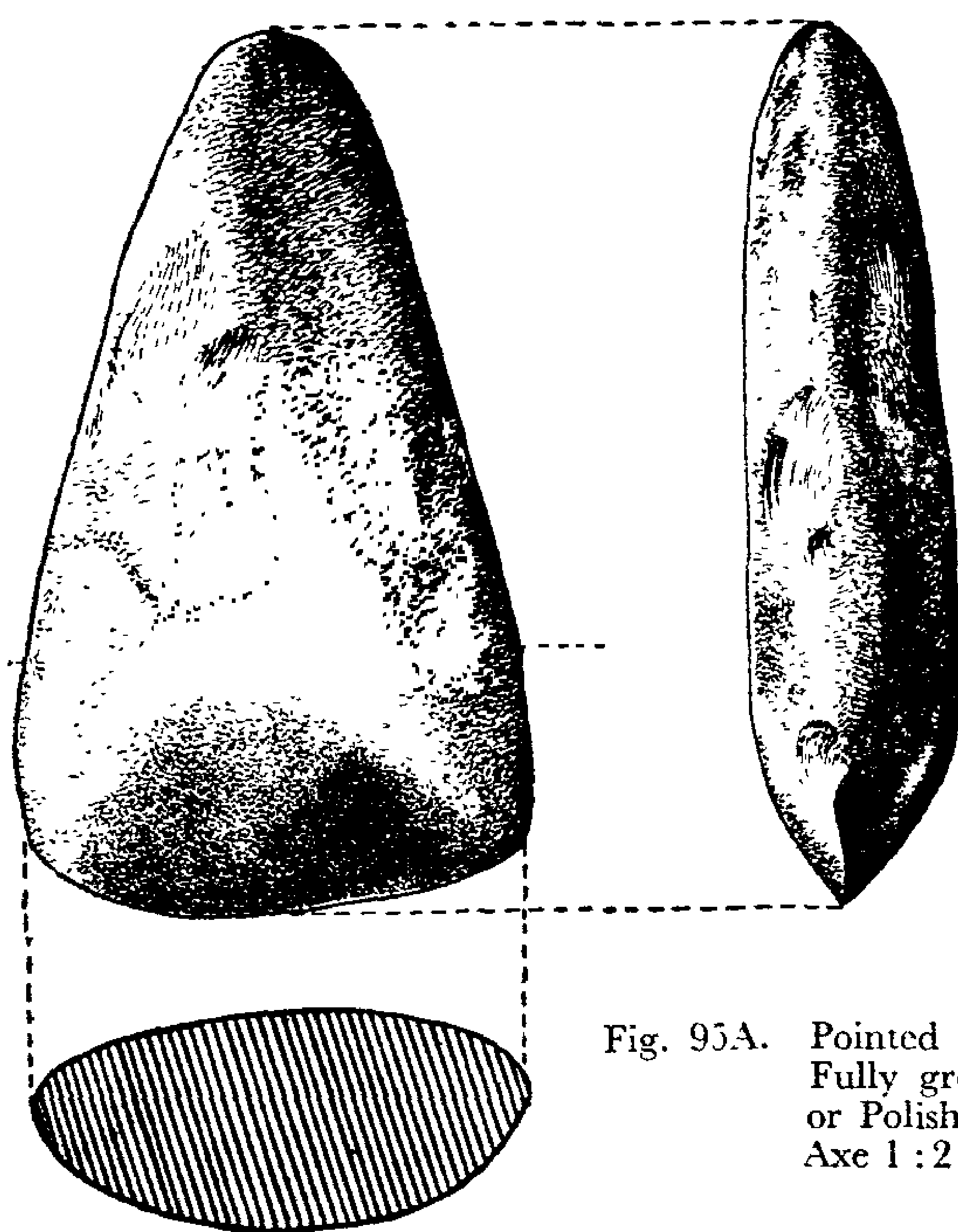


Fig. 95A. Pointed butt Fully ground or Polished Axe 1 : 2

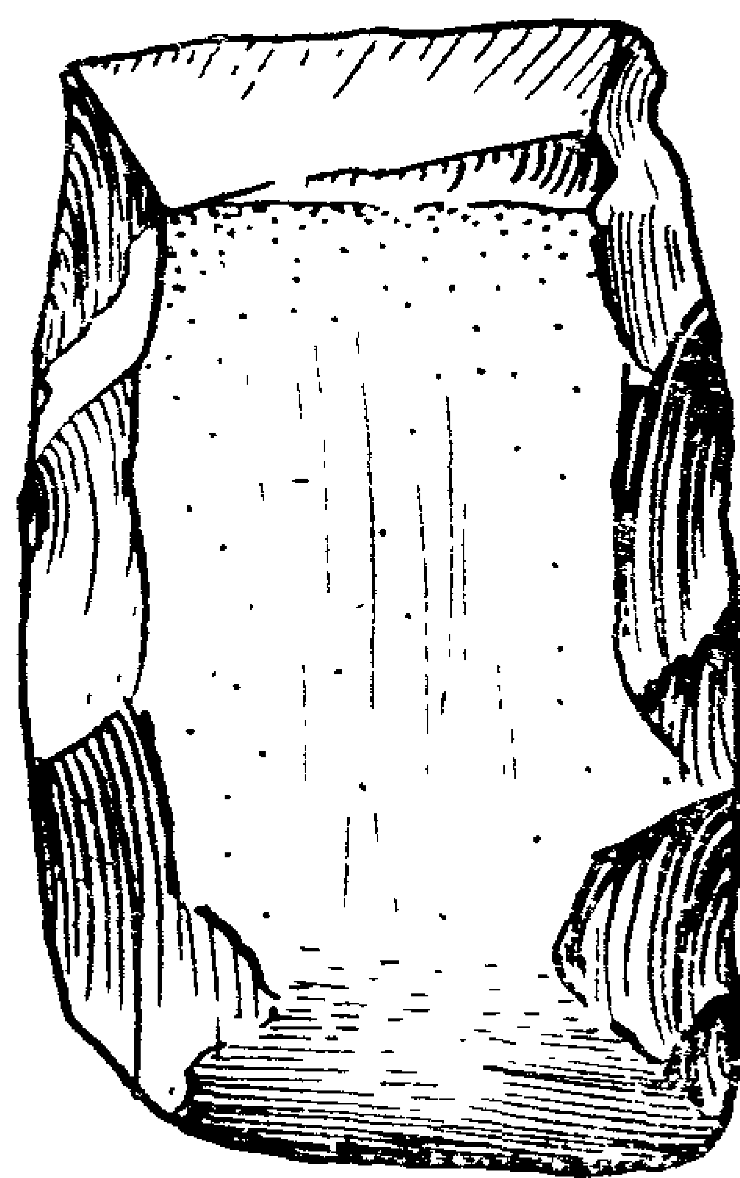


Fig. 96. Rectangular Butt Ground Axe 1 : 2

indicate its external appearance. A ground stone axe is roughly triangular in form, though the exact shape varies, it being broad or

1. COGHLAN, *op. cit.* p. 38.

narrow, and square or elongated. In an axe the two broader surfaces —the upper and the under—meet in a gentle or rarely oblique slope to form the cutting edge. The two lateral sides are thick (square, or rounded) or also sloping and intersecting at the broad base. The butt-end is pointed, rounded or even square or rectangular. (Fig. 96). Thus for a proper understanding of the ground stone axe type, *it is necessary to know its cross-section at the butt, in the centre and the edge.* It is generally fairly thick. For this thickness GALLARD[1] offers a very sensible explanation. It made it possible to strike the log of wood very forcibly without getting it stuck in the wood. Generally, the grinding or polishing is found on the broad cutting edge, at times on the body, and very rarely all over the surfaces. Such fully ground or polished axes are few, and are regarded more as precious possessions for ceremonial purposes rather than tools.

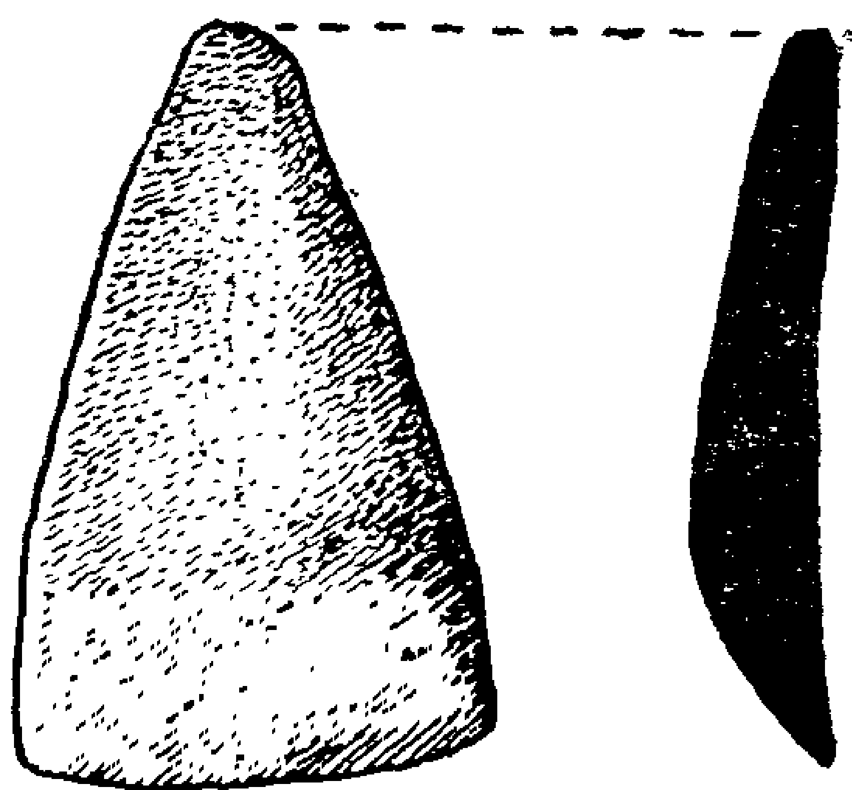
Whatever be the exact purpose[2] of such tools, the one characteristic feature of a ground axe is that it was hafted in such a way that the cutting edge was parallel to the handle. (Figs. 125-127). This distinguishes it from the adze. Polished Stone Axe can with speed and ease split a casurina log over a foot in diameter. The thickness of the blade made it possible to strike the log very forcefully without getting it stuck in the wood. And even after such a use the blade was razor-keen. Similar observation of EVANS has been cited by COGHLAN. An oak tree eight inches in diameter could be cut down without injury to the blade.

Adze (Fig. 97)

An adze is a thinnish, triangular piece, made normally on a flake. It is flat on one surface, while the other is slightly convex and meets at the edge; the section is planoconvex and the edge bevelled. The bevelling might in some cases be done from both the surfaces.

As adze is essentially a carpenter's tool, (though it is said to be used for agricultural purposes also) meant for smoothing and bevelling irregular surfaces of wood. Hence it is hafted in such a way that the cutting edge is transverse; that is, at right angles to the handle. (Fig. 128). As a rule, it is the bevelled edge which is ground

1. GALLARD, *op. cit.*, pp. 468 and 480.
2. One of its purposes was felling of trees. GALLARD (*Ibid.*) noticed that even after speedily splitting a casurina over a foot in diameter, the edge of the blade was razor sharp.
3. COGHLAN, *JRAI.*, LXXIII, p 30.



(on the inner face only) while the entire outer face is slightly rounded.[1] The earliest hafted specimen was found at Arpachiyah[2] in Iraq.

Fig. 97. Adze 1:1

Chisel (Figs. 98-99)

Like any metal chisel, of which it is an exact prototype, a stone chisel is a small, narrow, cylindrical or rectangular piece, with two of its smoother sides tapering half way down the edge to form a broad edge. This as well as the adze "are applied to the timber so that the edge cuts the timber on a wide front across the fibre of the wood".[3]

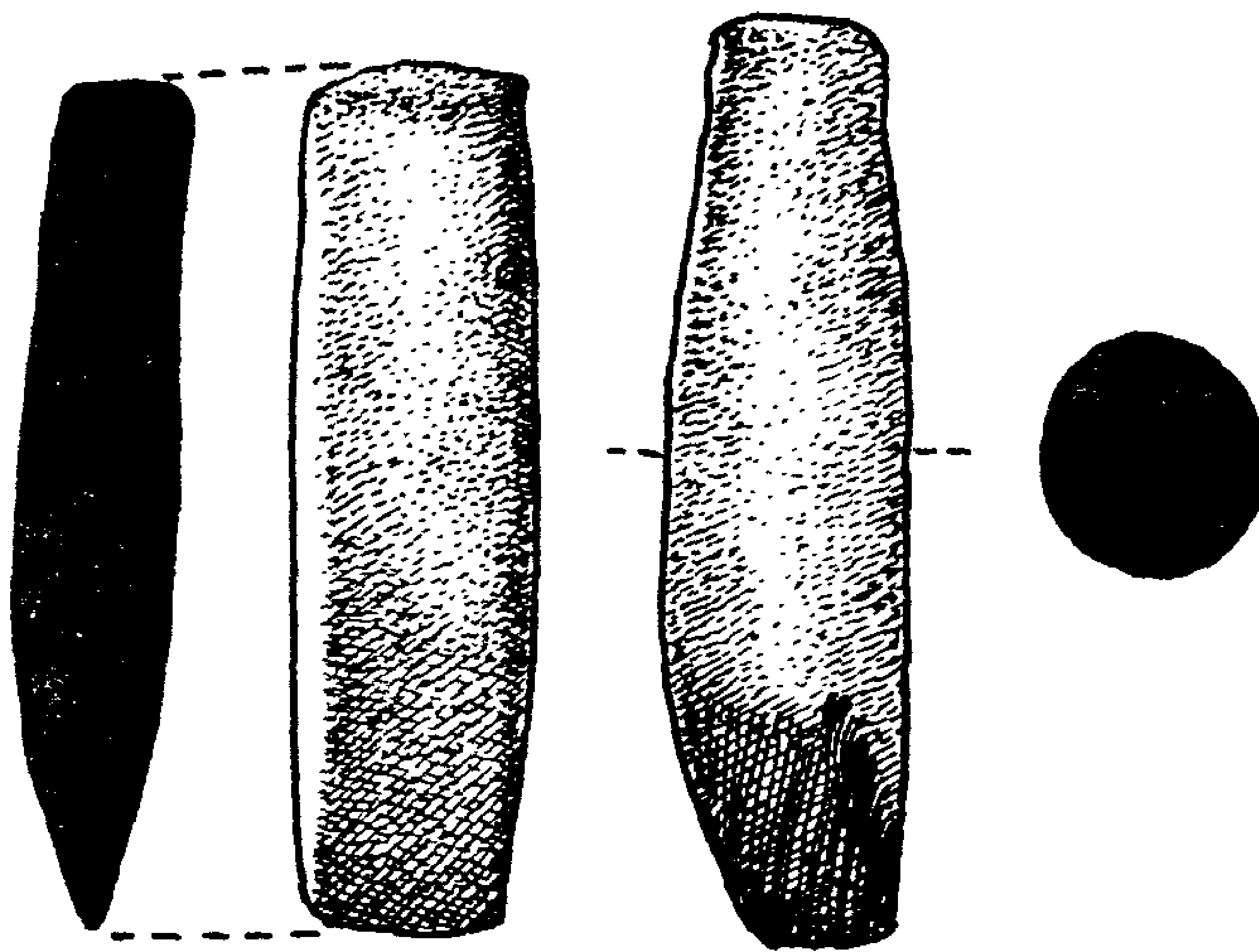


Fig. 98 Fig. 99

Figs. 98-99. Chisels with square and circular sections 1:2

Ring-Stones (Fig. 100)

These are comparatively thick, small, round or rectangular stones with their surfaces smoothed by pecking and grinding, having a central hole, about half-an-inch or even an inch in diameter, bored

1. *Ibid., p.* 0J.
2. *Ibid., p.* 38 and *Iraq*, Vol. II.
3. SKINNER, *Antiquity*, Vol. XXII, p. 208.

from both the surfaces. Thus in section this hole resembles the ancient hour glass, broad at the top, and narrow in the centre.

The side of the stone is generally convex or rounded, but in Eastern India and China stones with highly polished, and bevelled surfaces are noticed. Such ring-stones seem to have been used as weights for digging sticks, and are thus suggestive of primitive agriculture. But it is possible that they also served as mace-heads, examples of which are available from a number of Chalcolithic sites in Western Asia and India.

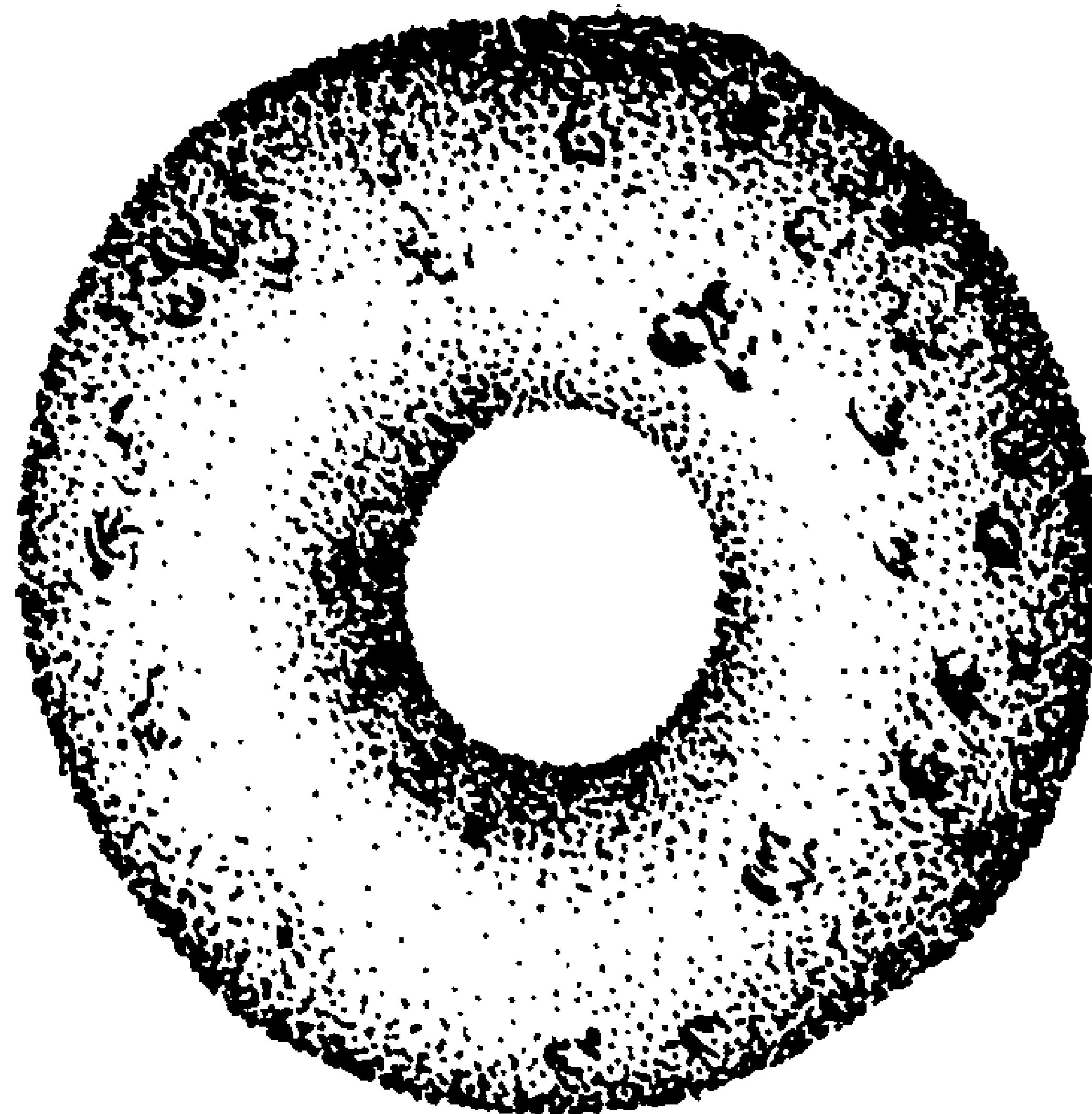


Fig. 100. Ring-stone or Mace-head 1:2

Fabricators (Fig. 101)

This term was first used by Robert Bruce FOOTE to describe a small, roughly cylindrical type of hammerstone with blunt ends. These are often bruised indicating that the tool was used as a punch. It is believed to have been used as a punch for dressing axes and similar ground tools. The tool is also called cylindrical hand-hammer or a flaking tool.

Saddle Querns or Mill-stones (Fig. 102)

It is at this period particularly that comparatively large, roughly square or rectangular stone slabs with flattish or concave surfaces begin to appear along with ground stone tools in habitation deposits. Since the flat surfaces have been smoothed and/or

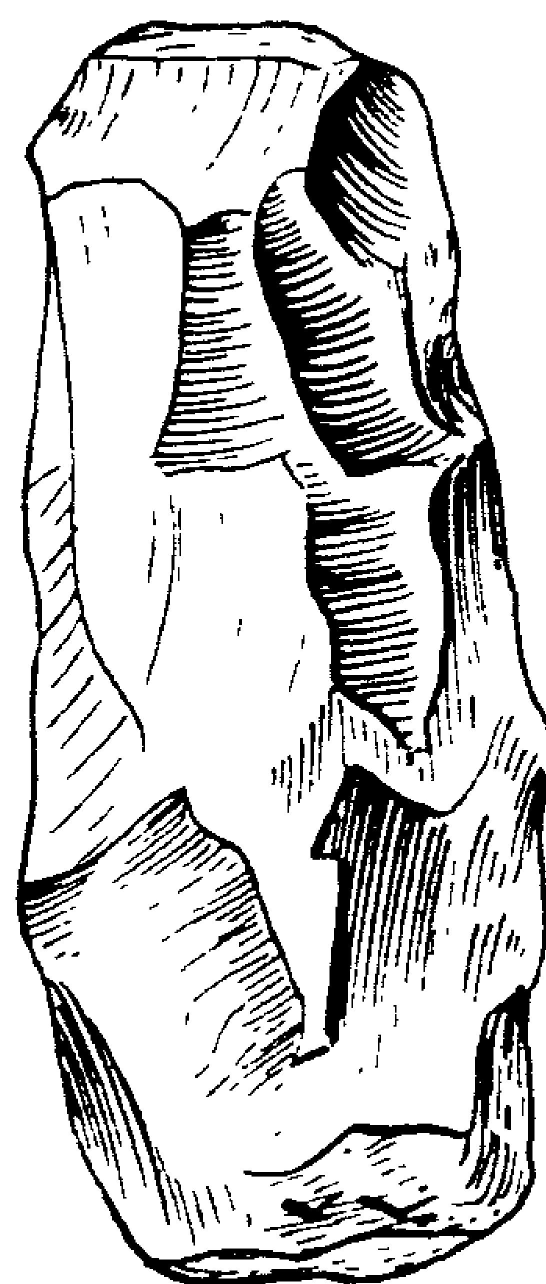


Fig. 101. Fabricator 1:2



Fig. 102. Saddle Quern or Mill-stone 1:4

hollowed by use, these have been interpreted as stone slabs which were employed by man for crushing and grinding or milling grain which was intentionally grown or collected wild. Such mill-stones were called "cweorn" in Old English and since these stones also resembled riding saddles, they are called in archaeological literature "Saddle Querns".

Three types may be distinguished:

(a) Quern with a circular grinding surface, brought about by round, ball-like hammerstones or mullers;

(b) Querns showing up-and-down grinding surface with plano-convex mullers (Fig. 103). This might have been originally a flat-surfaced quern with a rounded bottom. (Fig. 104).

(c) Querns exhibiting both these features.

Mullers (Figs. 103-105).

These are stone tools used for grinding grain as well as other material like pepper etc. They are in use all over India even today. But we can definitely see a kind of change and evolution in the type used, which seems to correspond with the changing habits and diet of men.

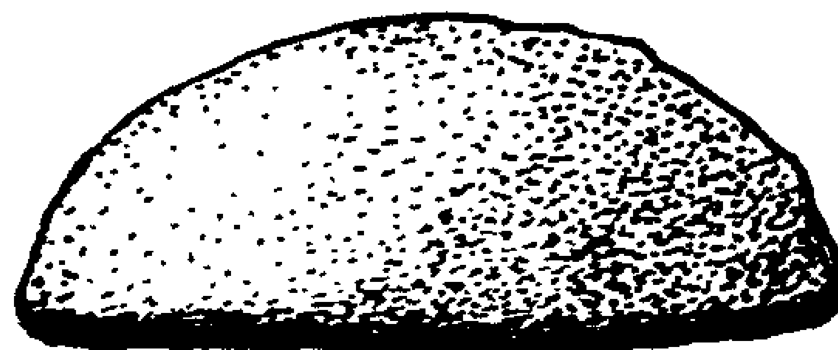


Fig. 103. Muller 1 : 4

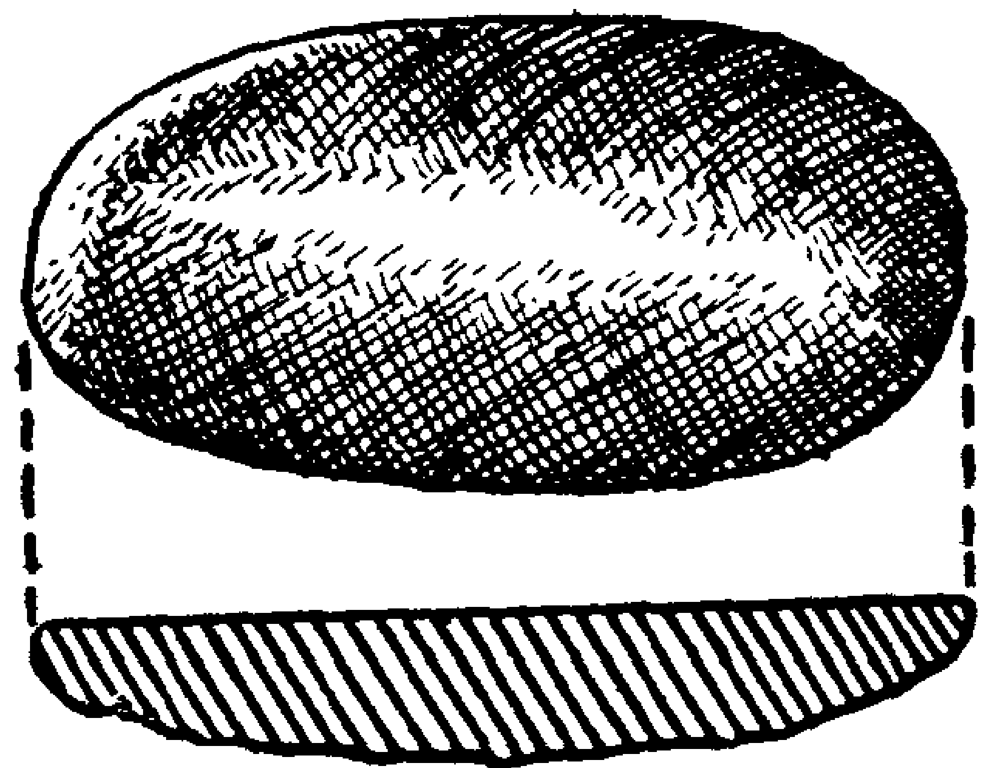


Fig. 104. Flattish Quern 1 : 4

While during the earliest period and for a long time to come, man seems to have used only natural pebbles for grinding purposes, we have undoubted evidence that from the time he began to cultivate cereals and pound them into some kind of flour, an attempt was made to select stones suitable to his needs and also to "treat" them before using. With these the grain was crushed on a quern (described above) and a kind of flour prepared.

According to the shape and surface treatment of the muller, several types and sub-types may be had.

(a) Round ball-like muller, with surfaces "pecked" or roughened for grinding.

(b) Round, but having two surfaces flattened or naturally flat.

(c) Plano-convex mullers, having one surface flat and the other convex or slightly rounded. (Figs. 103-105).

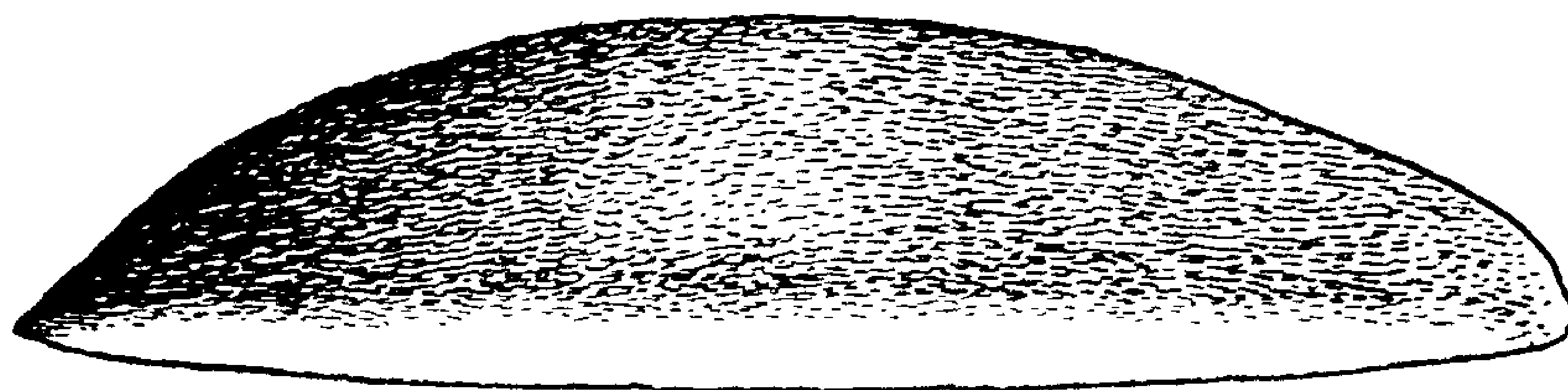


Fig. 105. Biconvex Muller 1 : 2

(d) Cylindrical mullers.

(e) Cylindrical mullers thicker at the two ends, and thinner for the most part due to use and the shape of the quern, the latter being smaller than the muller.

Types (a), (b) and (c) occur prominently in the Neolithic and Chalcolithic or early agricultural communities, whereas types (d) and (e) characterize the Iron Age.

Shouldered Tool (Fig. 106)

While the ground stone tools described above occur almost all over India, there is a class of tools, the distribution of which is primarily confined to South-East Asia, Burma and Eastern India. This tool is called "Shouldered Tool", its chief feature being the prolongation of the butt-end into a tenon to provide a suitable half. In some instances the tenon and the body are square, and the right angle between them is sharply cut or sawed by a wire-like "instrument", probably a metal one.

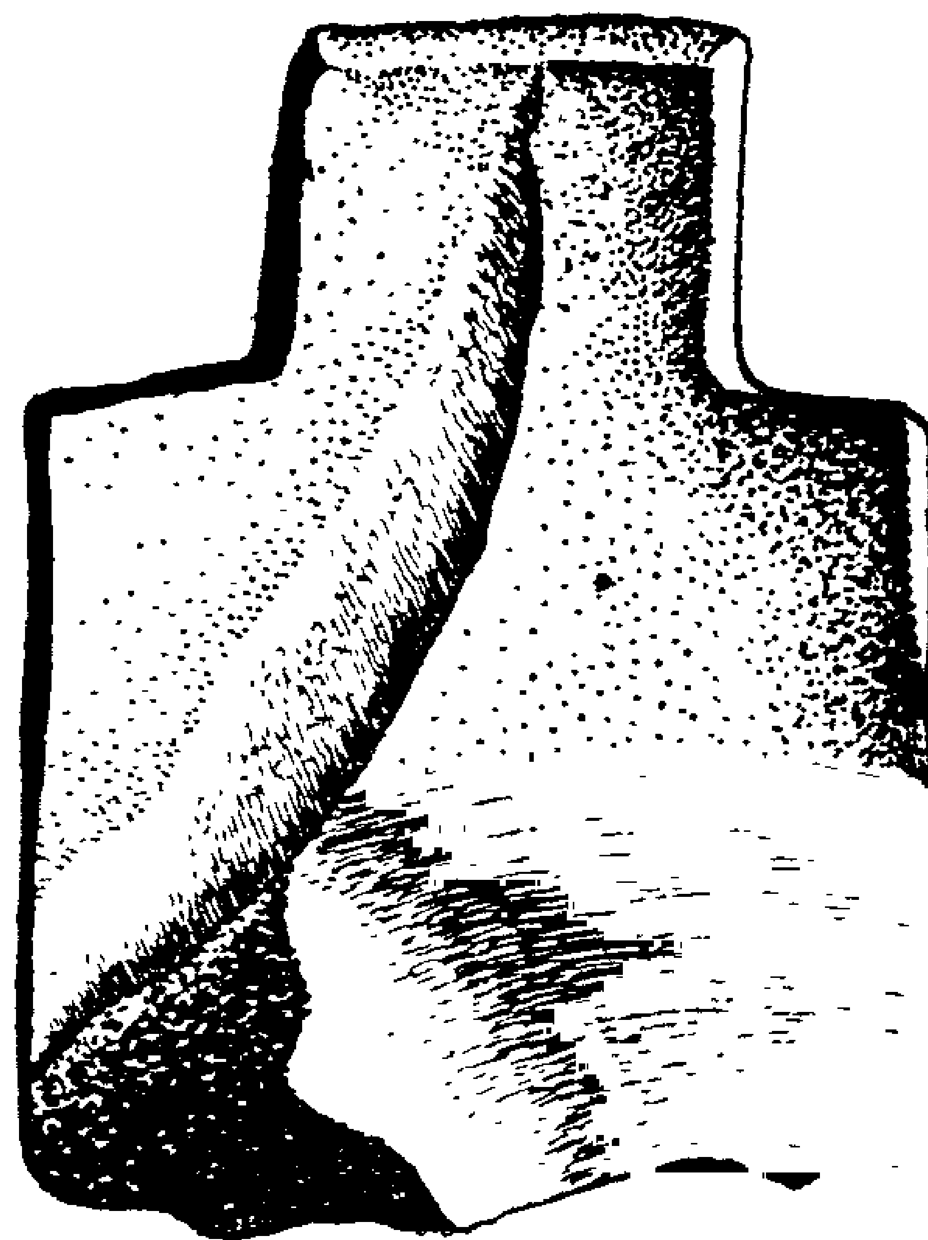


Fig. 106. Shouldered Tool 1:2

Functions: Stone Age Tools

While describing the various tool types characterizing the Early, Middle, and Late Stone Ages as well as the Neolithic, the function which a tool was supposed to perform was more or less hinted at or taken into consideration. This question may now be discussed in greater detail, as far as the data at our disposal permit.

The nature of the data or information varies from period to period. For the Early Stone Age we have no evidence at all. For this period of man's life is very far removed from our times, so much so that even some of the most primitive tribes in Africa, the Andaman Islands, Tasmania, Australia, New Zealand and New Guinea are not known to manufacture stone tools *exactly* like the handaxes and cleavers. *Comparative ethnography* is thus not of much help in understanding the probable or exact function of the tool falling within the Early Stone Age.

We have got to fall back upon the form or shape of the tool, noting in particular the form and position of the cutting edge or the point for piercing etc. and its relation to what has been called the butt end or the end from which the tool was held either in the hand or hafted in a handle.

Robert Bruce FOOTE[1] with his characteristic foresight had already taken these factors into consideration and grouped the tools according to their shape and function into:

Axes	1. Pointed Oval
	2. Oval
	3. Square-edged (Madras type)
	4. Oblique-edged (Guillotine sub-type)
Spears	5. Narrow type
	6. Broad-based type
Digging tools	7. Pointed with thick pebble butts.
Circular implements	8. Hurling stones with sharp edges all round
Choppers	9. Pointed oval with sharp edge on one side.

1. *IPPA.*, Notes on their Ages and Distribution, 1916, p. 9.

Scrapers	10.
Knives	11.
Cores	12.
Hammerstones	13.

The question whether these early Palaeolithic tools were hafted or not had drawn the attention of some of the earliest discoverers of these tools.

Boucher dePERTHES[1] thought that some (tools) were hafted and some not, while G. deMORTILLET[2] thought that all were hafted, while a third scholar held that none were hafted. Without going into further inquiry about the earlier views, it will be shown in the sequel that Boucher de PERTHES as well as FOOTE were right in their views. FOOTE had further cited spear-like forms from England, France and elsewhere and even shown with the help of illustrations how a spear-head-like stone tool could be hafted in a wood or bamboo shaft.[3]

But since these scholars wrote, we have obtained more evidence about the evolution or development of the various tool types within the Early Stone Age, particularly at Olduvai in East Africa.[4] Briefly the pebble tools, called choppers, are the earliest These are followed by heavy pebble-butted, keeled, pointed handaxes. The latter gradually become finer, thinner and more symmetrical having an edge around the periphery. The finest of these are the ovates and are universally made on flakes, whether it be in India, South, East or North Africa or Western Europe. Often this handaxe is further pointed on both the ends, or on one end it has a broad cleaver-edge, or a chisel-like edge, whereas the other end is pointed.

If we now examine these forms, the conclusion is inescapable that man had gradually begun to haft his tools and also to manufacture specialized forms for different purposes. Though we have no full data, the following stages may be postulated.

1. *Antiquities celtiques et antediluviennes,* ii, 1857, iii, 1864, p. 74, cited by SOLLAS, W. J., *Ancient Hunters,* 1924, pp. 113, fn. 2.

2. *Le Pre'historique,* 1885, p. 142, cited by SOLLAS, *ibid.*

3. FOOTE, *op. cit.,* p. 173 (Here Fig. 114).

4. LEAKEY, *Olduvai Gorge,* pp. 34-40; 41-72; 73-86; 87-128. In none of the tools from LEAKEY's stages 1-3, 4-5, one can cite a tool which could have been hafted in a withy or some such haft. But in stages 6-8 and 9-11, we have comparatively thin symmetrical handaxes and cleavers with pointed, fully flaked butt (Fig. 50, p. 126), which would necessitate a haft.

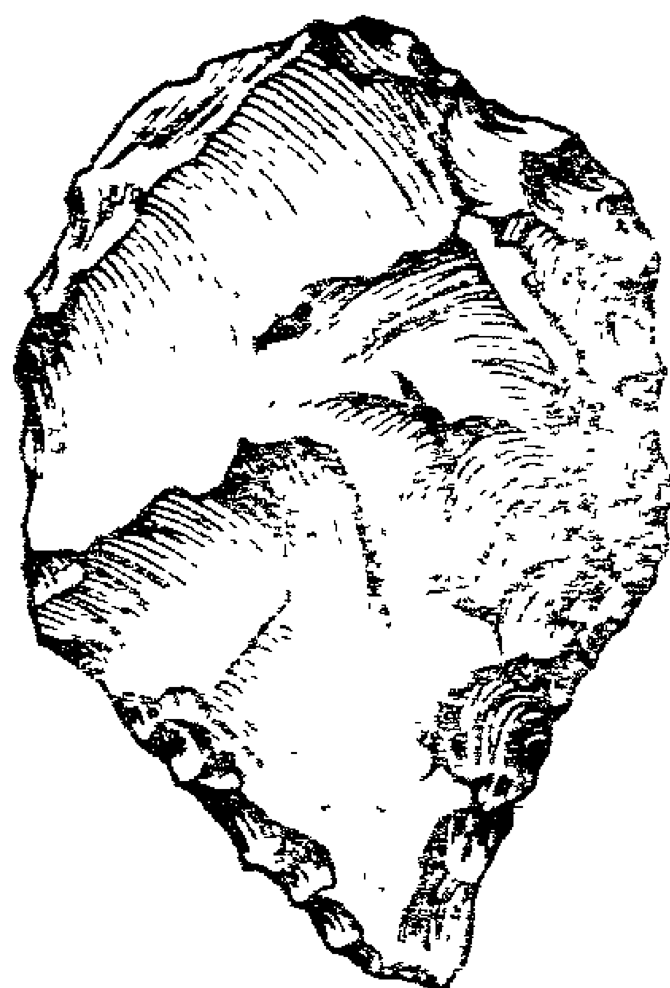


Fig. 107 : Handaxe

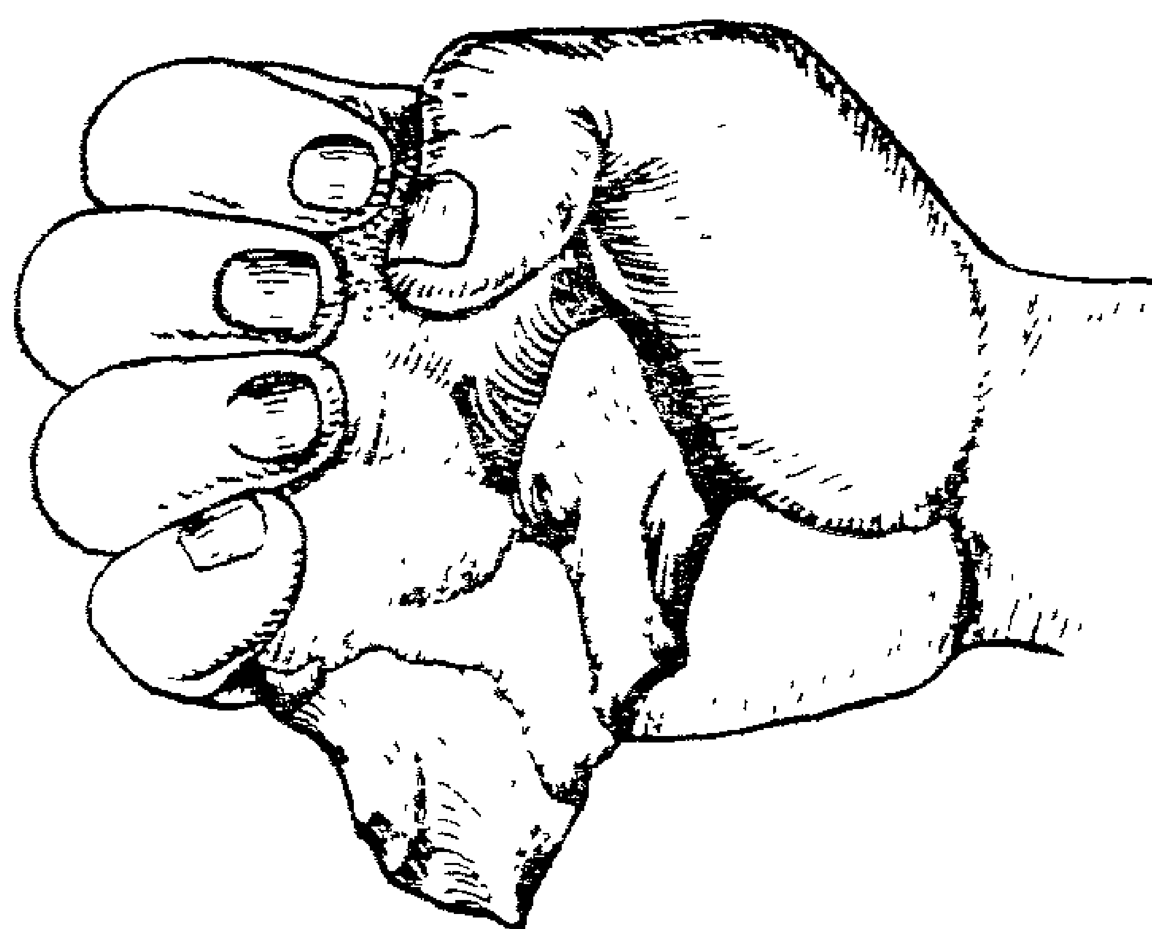


Fig. 108 : Digging

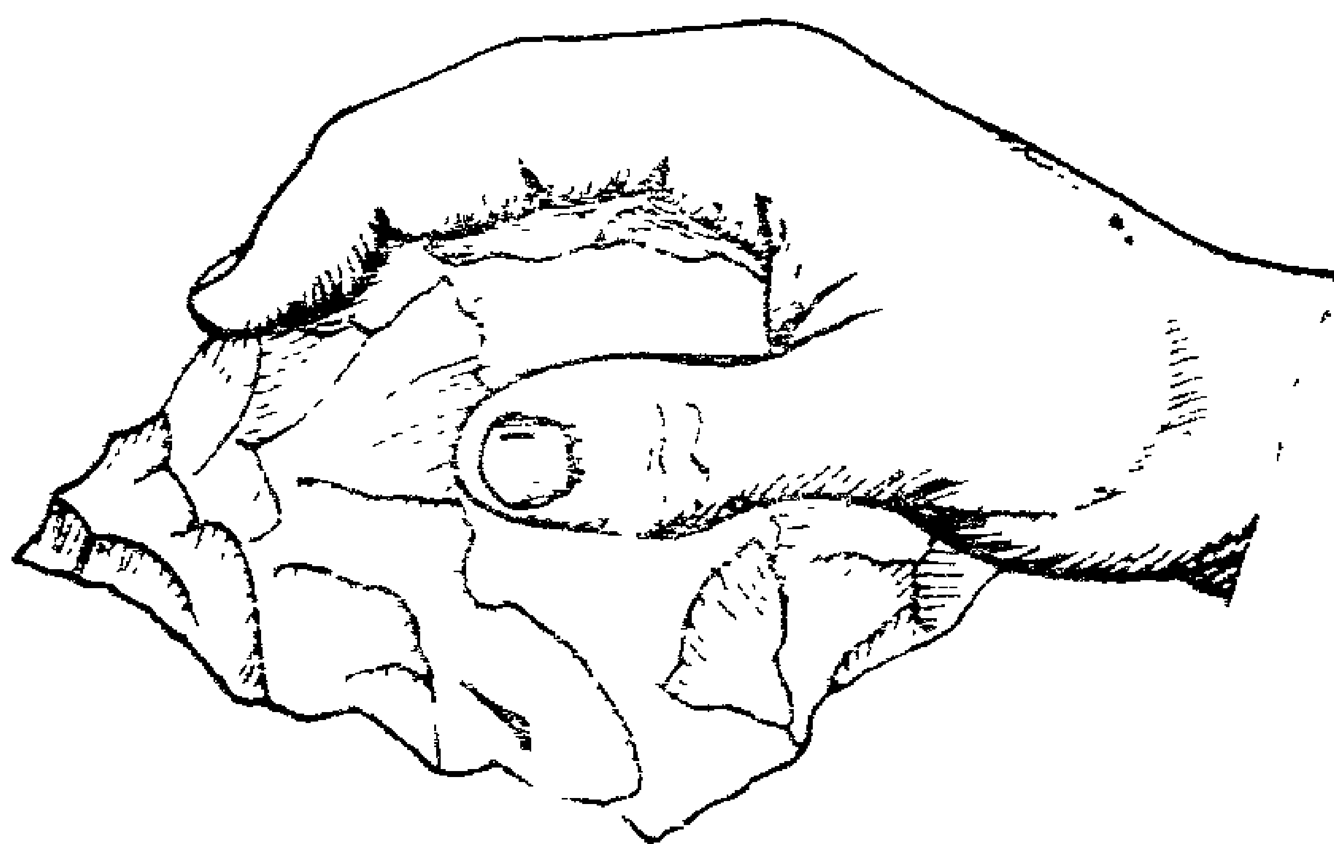


Fig. 109 : Cutting



Fig 110 : Boring

Figs. 107-110. Illustrate the use of early hand axe as an all purpose tool 1 : 2

	Function
I. *Era of all purpose hand-tools.*	Like choppers and chopping tools and early handaxes made on pebbles, pebble-halves and large flakes.
II. (a) *Era of incipient specialization.* Early, heavy, pebble-butted handaxes	Digging up edible roots, grubbers and the like, (well-expressed in Sanskrit as *kanda-mula*) that is, vegetables like potatoes, radish, which grow underground; also perhaps used as mattocks for cutting up and smashing an ambushed animal.

(b) *Era of incipient specialization.* Besides the h e a v y, pebble-butted handaxes, more pointed and symmetrical shapes appeared.	These might have been used for similar grubbing purposes and cutting up animals and dressing their skins etc.
(c) *Era of incipient specialization.* Though the old forms continue, fully flaked handaxes now appear though with comparatively h e a v y butts, and well-formed pointed ends.	These could have served as spear-heads and be hafted in wood or bamboo. (See Fig. 115)
III. *Era of specialization.* Various types of handaxes, cleavers and scrapers (See p. 107).	
(a) Heavy or medium butted, pointed handaxes	Spear-heads, various types, according to shapes.
(b) Ovates, and fully worked handaxes, with edge all-round. Some of the ovates are so thin and small that they could hardly have been useful for digging. These would break in no time. Hence hurling or throwing either by the naked hand or with the help of a thrower is the most probable use. Some of these have a deliberately made 'waist' or notches on the two lateral sides. Though no examples from India are known to the writer, notched Middle Acheulian ovates and	Disc or disc-like purposes, for hurling against an enemy. (human or animal).

similar early Levallois flakes have been reported from Warsash, Hampshire (England) and Montieres (France) respectively[1] (Figs. 111-112).



Fig. 111. Levallois flake with a "waist" from Montieres, France



Fig. 112. Middle Acheulian Handaxe with a "waist" from Warsash, England

(c) Cleaver-cum-handaxe	Axe-cum-pick, precursor of iron or bronze form, for cutting, digging etc.
(d) Cleaver, various forms. In many a cleaver, the longer sides are trimmed from both surfaces, which definitely indicates that such cleavers	Primarily cutting or chopping. From the fact that very rarely the edge is battered, it is more probable that these were used, as Desmond

1. Burkitt, M. C., Paterson, T. T., and Mogridge, G. J., "The Lower Palaeolithic Industries near Warsash", *PPS.*, Vol. V (1939), p. 39 ff. Fig. 6, 1-2 and Fig. 1.

were hafted. A typical example from Lalitpur, Central India is illustrated (Fig. 113).

CLARK has said, for cutting up animals.

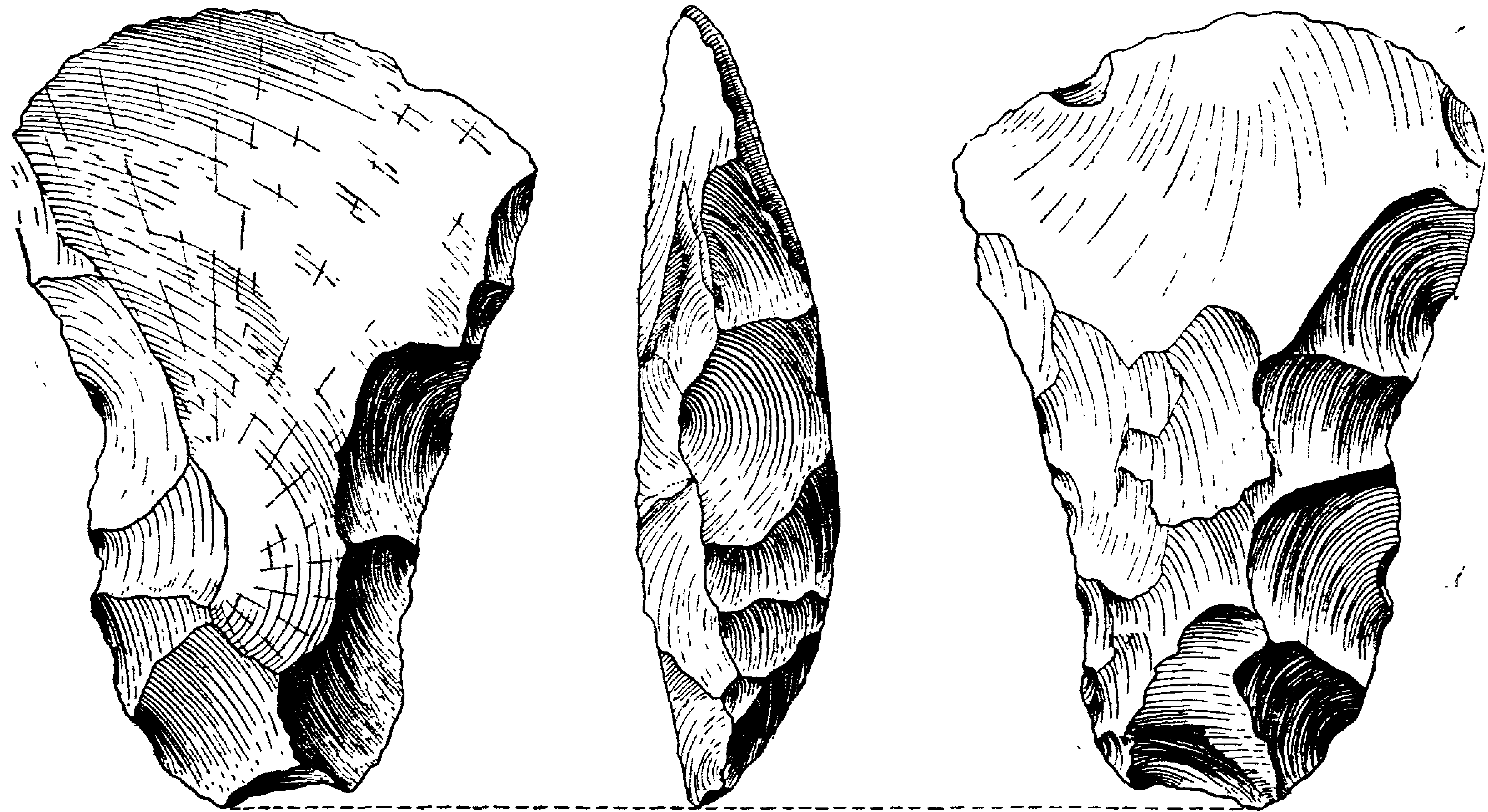


Fig. 113. Cleaver with trimmed sides and butt for hafting from Lalitpur 1:2

(e) Scrapers. These are usually large and with a natural hand-hold on one side.

For dressing the skins of animals and smoothing tree trunks etc. as also for skinning the game. Used in the bare hand.

Thus we see that quite early in the Early Stone Age, man had begun to fashion tools and weapons for various purposes, and some of these like IIIa, IIIb, IIIc and IIId were most probably hafted. This hafting might have been done as shown separately.

Unlike the tools of the Early Stone Age, the Middle Stone Age tools (and weapons) resemble so much in size and shape and even in the technique of their preparation those still used by aboriginal

tribes in Australia and parts of Africa that we instinctively turn to these countries to have some understanding of the way of life of the prehistoric man, particularly in semi-tropical and tropical countries like India and Africa. Even in Australia Carbon-14 dates have now shown that tools in some of these areas would go back to at least 5000 years. Early writers, like SOLLAS, have already made some use of this evidence for illustrating their works. In addition some recent data is here cited. In Africa and in Australia, as well as in Europe, regional specialization has been noticed. However, the extent to which such regional specialization was practised in India, will take a considerable time for us to understand. At present not much difference is seen (except in size) between the Middle Stone Age tools of different regions. In fact some foreign scholars like Professor Desmond CLARK who have seen these tools think that these are unspecialized and probably there were others for specific purposes in wood and bone.

This point is well illustrated by the two recent discoveries. Dr. Donald F. THOMPSON[1] of the University of Melbourne, noticed that the Bindibu, a tribe of aborigines living in the Great Sandy Desert on the borders of Western Australia, lived almost exactly as their Stone Age ancestors did. They had not met any Europeans so far. These people employed spinifex tussocks as wind-breaks and the hard wood of the accasias and eucalyptus to make their simple tools and their barks to make ropes. They also made stone scrapers and adzes and used a big flat millstone, with a smaller top stone above for the preparation of vegetable food. And these tools which were believed not to be very old, have been found recently in deposits which Carbon-14 determinations have shown to be at least 5000 years old.[2]

So also in the New World, in far off Brazil, the kit of Sye Indians[3] consisted of chisels of animal teeth, petrified wood for sharpening arrows, rough leaves for sanding new wooden disks, monkey bones and candil spines of the fresh-water string ray for making arrow points and strips of inner bark for arrow ties.

While the so-called scrapers might have been used for various purposes, one tool-type needs a discussion. These are points or pointed tools. Are all these or some of them arrow-heads?

1. *ILN.*, December 9, 1961, pp. 1012-15.
2. *PPS.*, 1961.
3. *National Geographic*, January 1962, p. 118.

These are quite small and cannot be used in the naked hand. Secondly, a few of these are so symmetrically triangular with a mid-ridge and sides tapering into a point that the obvious inference would be that these were used as arrow-heads, the larger amongst them as javelin-or spear-heads. This is further supported by the fact that in a few cases, definite attempt has been made to haft the specimen, either by chipping off the upper or the lower surface at the butt end, or producing an incipient ill-formed tang. Such crude tangs are found even in specimens which may be regarded as scrapers.

Outside India, indubitable evidence of arrow—javeline—or spear-head is supplied by the beautiful bifacial tanged examples from North Africa, known after the type site *Bir-el-Ater* as Aterian, the Gravettian of the Western and the Solutrian of the Eastern and North-Western Europe and South-Eastern Spain[1]. However, no bows or arrows of an earlier Palaeolithic period have been found, either because these were non-existent or have not survived. Hence the exact function of these small points remains uncertain.

It should be mentioned that fine arrow-shafts from Stillmoor, near Ahrensburg clearly "show that the late glacial hunters of Schleswig-Holstein were using bows in the 9th millennium B.C.' These were probably long-bows. Wooden arrow-shafts of Mesolithic age in Europe have also been found, whereas archers with long bows and arrows have been depicted on rock-paintings of Eastern Spain. These belong to early non-glacial times. The story of bows is then continued in Neolithic times, of which only recently two remains of long bows of yew trunks (when complete about 5 ft. 2 inches and 6 ft. 3 inches, respectively) were accidently unearthed in Somerset, England. On various evidences, these can be dated to about 2700 B.C.[2]

Though in none of the above-mentioned four regions a fully hafted arrow or javelin or spear is yet found, still the users are regarded as the earliest Palaeolithic hunters with the bow and an arrow. In India, this claim can well be made by the Middle Stone Age man, whatever be his date and likely relationship with that of Africa. For among his stone relics we do find, as mentioned above, examples which have to be regarded as arrow—javeline—or spear-

1. See Caton-Thompson in *JRAI.*, Vol. LXXVI, pp. 89 and 115.
2. *ILN.*, February 10, 1962, pp. 219-21.

heads,[1] though these are much cruder than the African and European specimens.

In the succeeding age, the Late Stone Age, the various types of microliths were admittedly used as compound tools, still their exact use or the method of hafting eludes us. A few examples will make this clear.

These and similar ones went to make up a sickle blade, as actual specimens in bone, wood and clay from Egypt, Iraq, Iran and Turkey prove (Figs. 120, 124).

The following stages in the methods of hafting or the evolution of the modern types of tools and weapons can be visualized. These almost synchronize with the main stages of man's development.

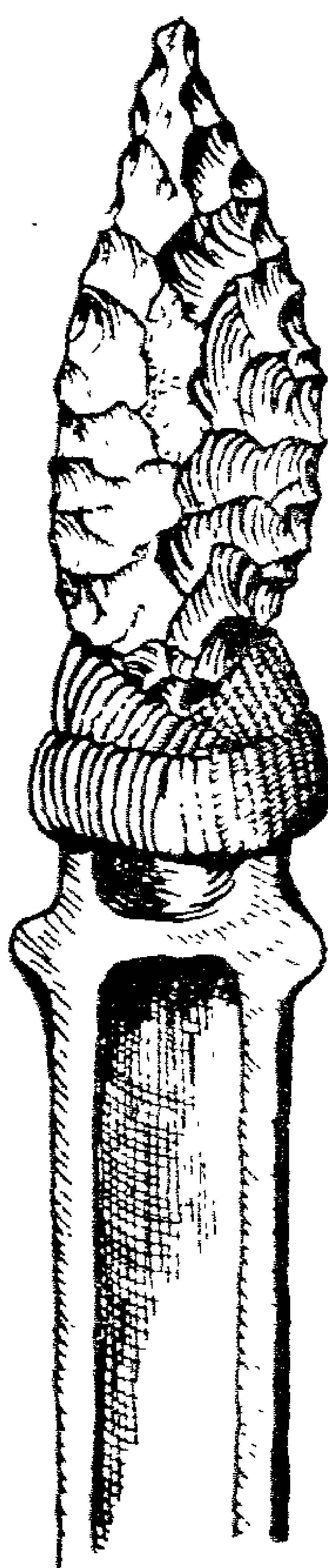


Fig. 114.
Spear-head type Handaxe hafted in a bamboo pole 1:2

Spear-head type Handaxe

Methods of hafting

As described by FOOTE, a bamboo pole of a suitable size could be selected, then cut off at the head end, some three inches above one of the joints. This would provide a very good natural socket for the implement to be inserted and then wedge in quite tight with wooden wedges and then tied with a strong lashing round the base of the quartzite head to secure it still further. (Fig. 114).

Where bamboos are not available, for instance in cold temperate countries of Western Europe, FOOTE thought that such spear-shaped handaxes could have been inserted into a split long pole and lashed (Fig. 115).

Though cordate or heart-shaped handaxes could also have been hafted in the manner described above, FOOTE thought that spear-head type handaxes were most suitable.

Cleaver of the type illustrated here (Fig. 113) could also be similarly hafted. The way its side and the U-shaped butt have been chipped could only have been meant to facilitate hafting.

The three or four recurring types of tools of the Middle Stone Age must also have been hafted in the manner here suggested.

1. Such a claim can well be supported from comparative ethnography. The Australian aborigines have been known to have valued "points" of all kinds, and many of the Indian specimens could have served as daggers, javelin or spear-heads. But the bow and arrow are said to be unknown in Australia. So the analogy could not be further extended.

(Figs. 116-117). For they are only smaller in size than the tools of the Early Stone Age. Otherwise except for a small incipient tang no other provision is made for hafting them. (Fig. 61). This tang-like portion, however, could either have been inserted in a slit cut out in a bone or wooden handle and then the whole firmly tied up with a fibre and further strengthened by the application of a gum-like mastic or inserted in a socketed handle of bone, wood, bamboo or reed.

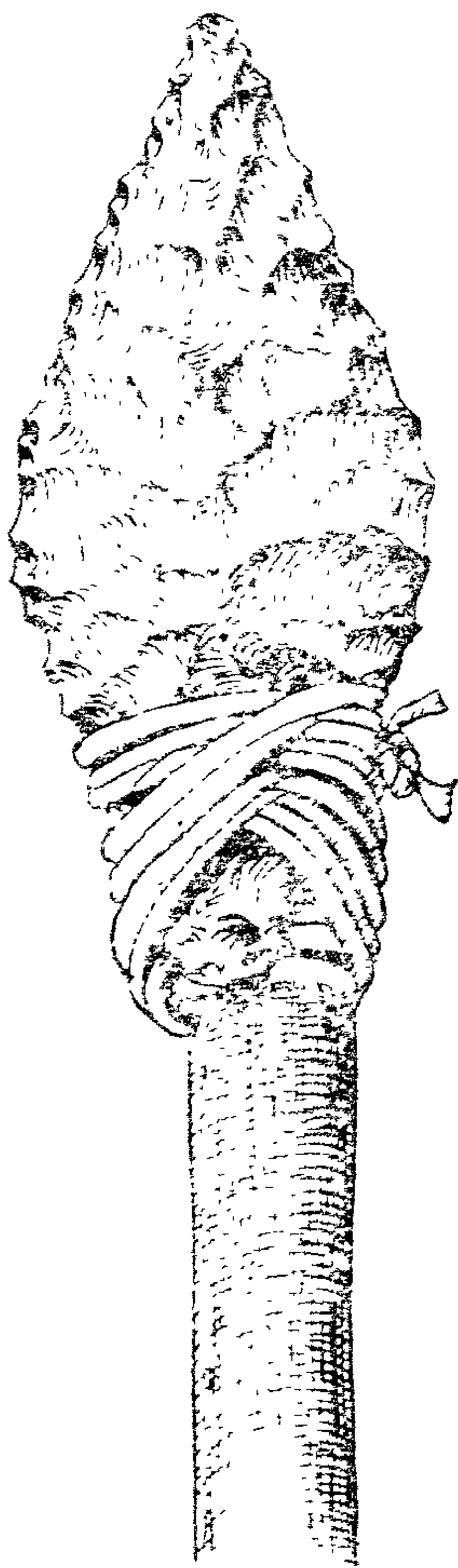


Fig. 115.
Spear-head axe hafted in a wooden pole 1:2

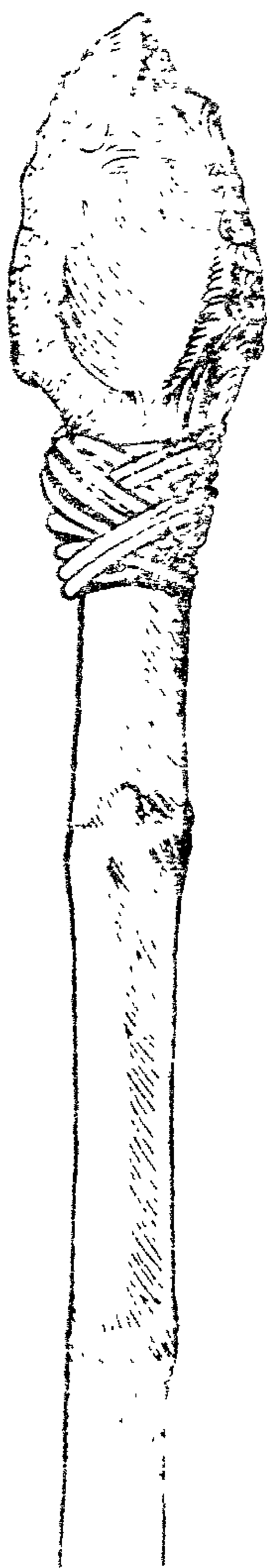


Fig. 116.

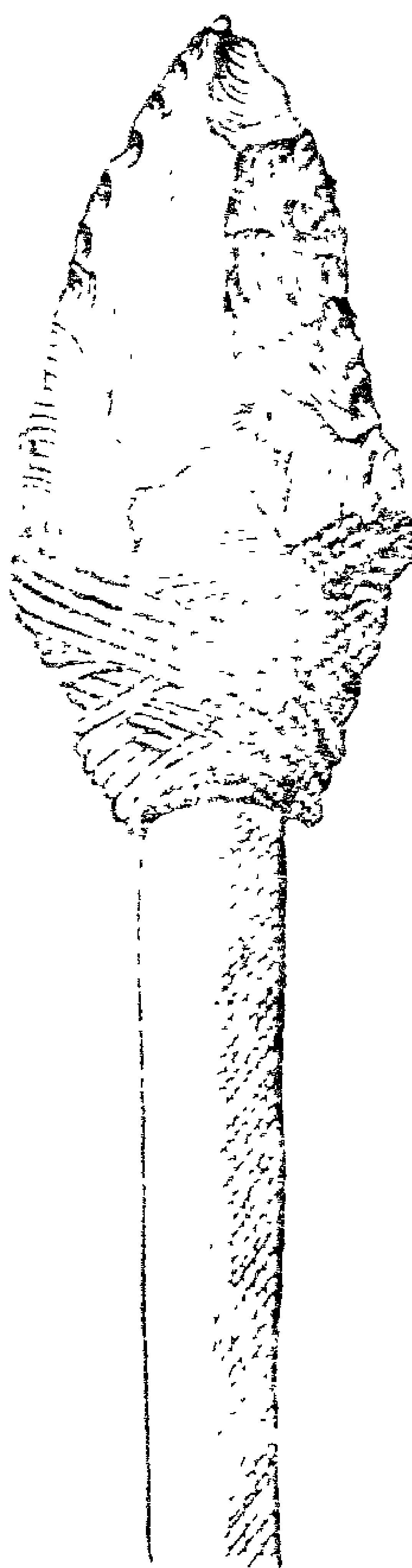


Fig. 117.

Fig. 116-117. Hafting a Middle Stone Age Point 1:1

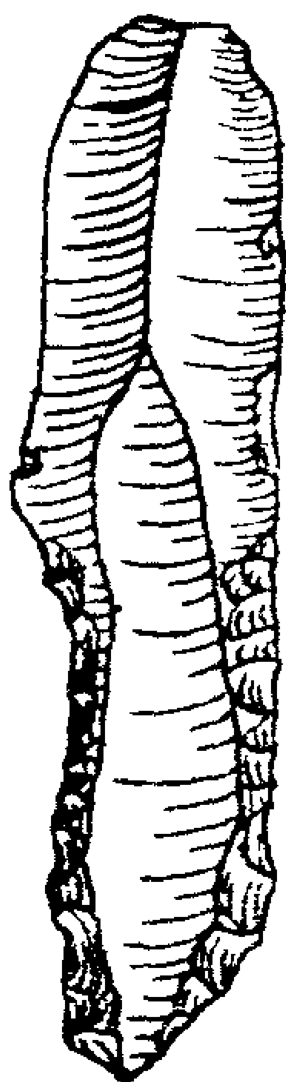


Fig. 117a

Tanged Scraper from Nevasa 1:1

Since such a socketed handle is not found in any of the Indian specimens current today, it is probable that the other method of hafting, viz. tying the tool to the haft, might have been the only one prevalent in India. Of course, this was not a very effective way of using a tool.

Though no specific evidence is available in India with regard to the hafting of tools and weapons during the Chalcolithic period in India, particularly with regard to the numerous parallel-sided blades, yet evidence is now forthcoming from the large collections from the excavations at Nevasa and Navdatoli that some at least of the points and edge-scrapers had a finely worked tang (Fig. 117a). Most probably this must have been inserted in a suitable socketed type of haft, though for this belief we have no data, whatsoever.

With the Neolithic there is not much difficulty. The various tool types have been found, sometimes with their hafts, from the peat bogs and lake-dwellings of Europe, though so far none such haft has turned up in India. In addition we have confirmatory evidence from the methods of hafting prevalent in primitive tribes. Select examples from both these are illustrated with, a view to bring the story up to date.

We may thus summarize the progress which man achieved by discovering various techniques of improving his stone tools through the Stone Ages.

In the beginning it is believed on certain evidence from the Makapansgat Valley caves in South Africa that man used as knife, slashing tool, dagger, scraper, pounder, saw, ripping bones and teeth and trunks of animals. These therefore may be called "ready-made" tools, before he himself began to make tools of stone, wood and bone.

Man's earliest tool, made by himself is called "pebble tool," later the " handaxe". It is described as an "all purpose tool", used for slicing, drilling, boring, scraping, chopping and sawing (Figs. 108-110). This stage lasted for some time. But as shown here (Figs. 111-115), contrary to the generally accepted opinion, we notice a little specialization in the preparation of the handaxes, and even attempts to haft them. These, however, did not affect the basic way of man's life. He remained a hunter and food-gatherer.

In the next phase of man's life we behold an important change. The tools became smaller. They are not many. But yet among the few

types, the thin pointed ones might indicate hunting with a bow and arrow, whereas the borers indicate a similar activity on wood and leather and drilling. (Fig. 118). Likewise, the various scrapers definitely indicate dressing of wooden handles as well as skins. (Fig. 119). The few blade-like tools of this period might have been used for slicing. This progress of man in India is somewhat similar to that in Europe and Africa, though he might not be their contemporary.

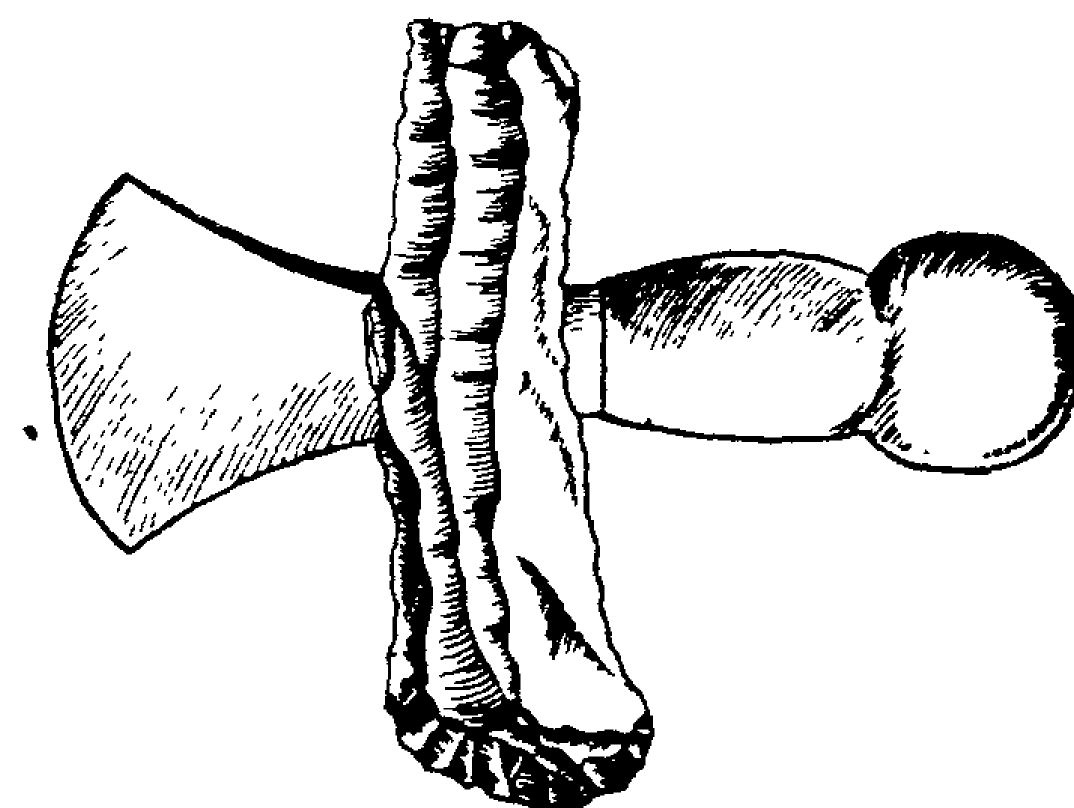


Fig. 119. Edge-Scraper on stone and Cobbler's tool for dressing leather 1:2

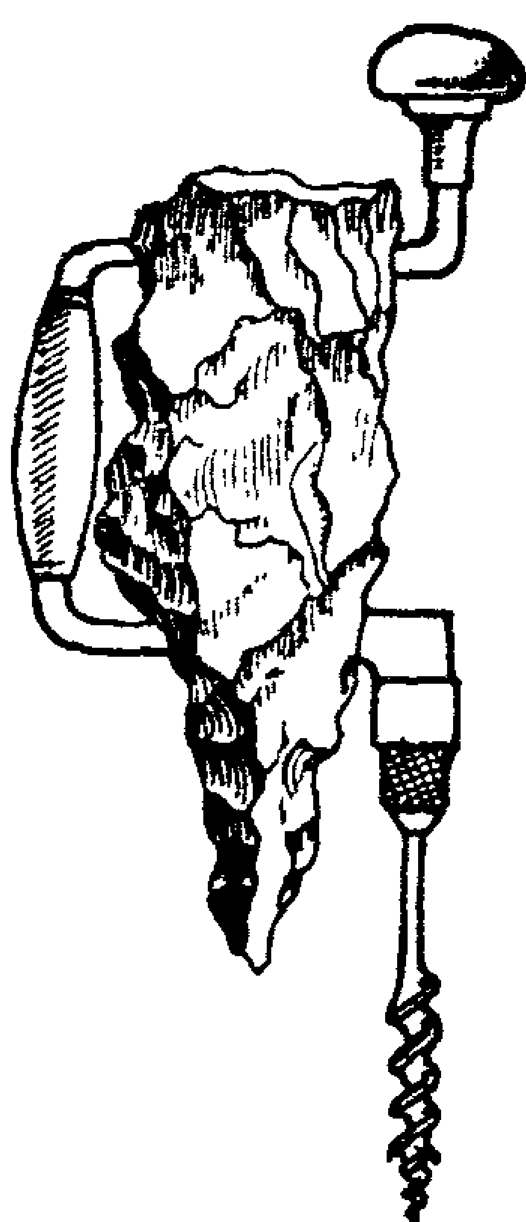


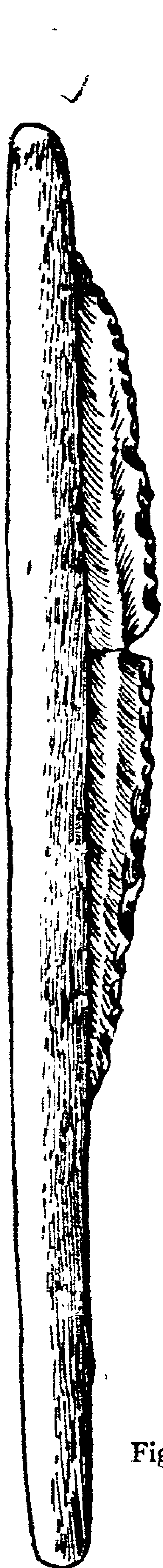
Fig. 118. Stone Borer and Steel Drill 1:2

The era of blades, which is the next stage, is not well known in India. On the analogy of similar tools from Europe and Africa, it may be inferred that he did prepare a sickle either of bone, wood, or even clay handle (Figs. 120-121). (For this purpose the large rhinoceros' rib bone from Langhnaj would have come very handy. It appears that he used the shoulder blade of this animal as an anvil)[1]. The small triangular points with or without mid-ridge might have served as arrow-heads and/or as barbs of harpoons (Fig. 124). But throughout these remained of a simple type, except for solitary specimens from Rajasthan. Penknife blades are indeed the forerunners of our modern steel penknives. (Fig. 123)

If man did manufacture a sickle with lunates, trapeze, etc. then it may be inferred that man had begun to eke out his

1. ZEUNER F. E., in *MAN*, Vol. LII, 1952, pp. 123-31.
2. *JRAI*, Vol. LXXIII, p. 38.

livelihood by primitive agriculture. Hunting with the bow and arrow was definitely there.



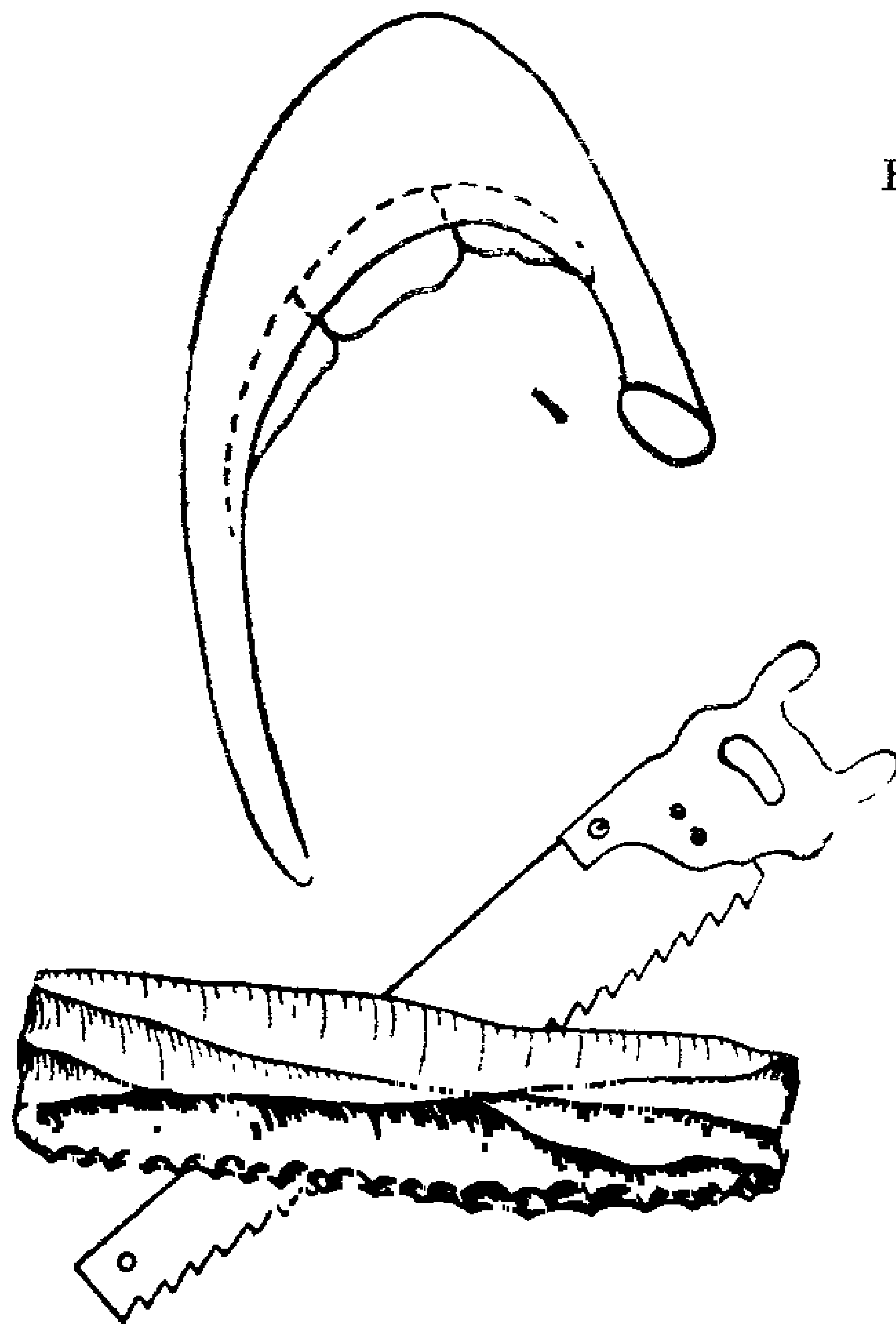


Fig. 121. Curved Sickle—microliths in a curved socket 1 : 1

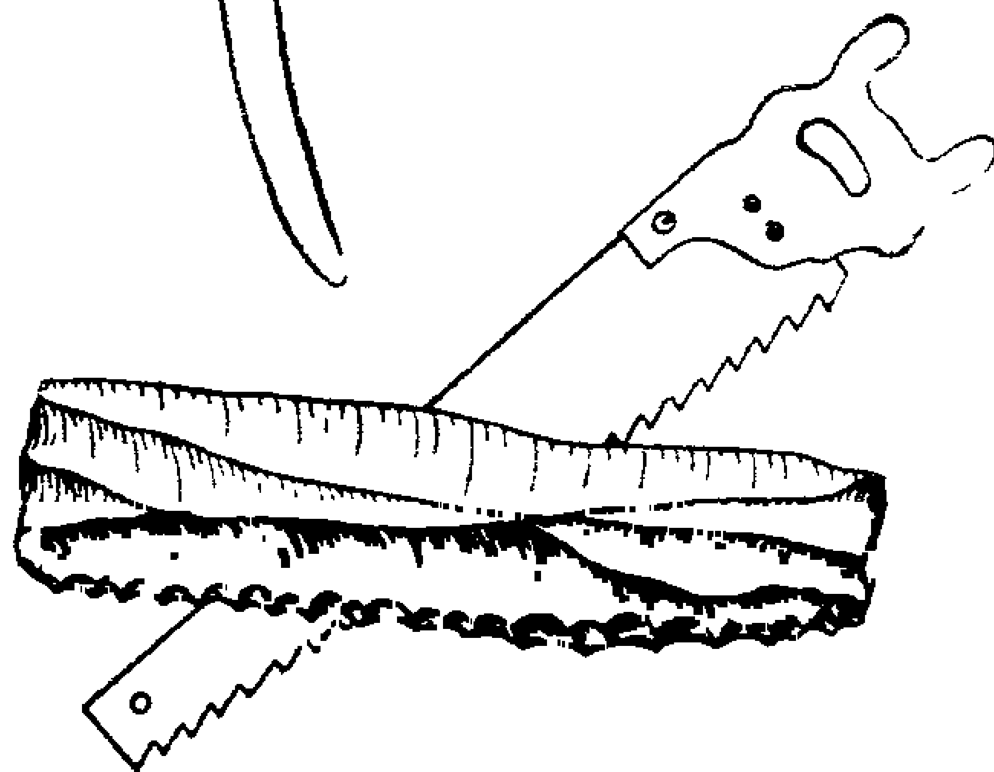


Fig. 122. Stone Saw and a modern Steel Saw with a wooden handle 1 : 2

Fig. 123. Penknife Blade in stone and a Steel-bladed penknife 1 : 2

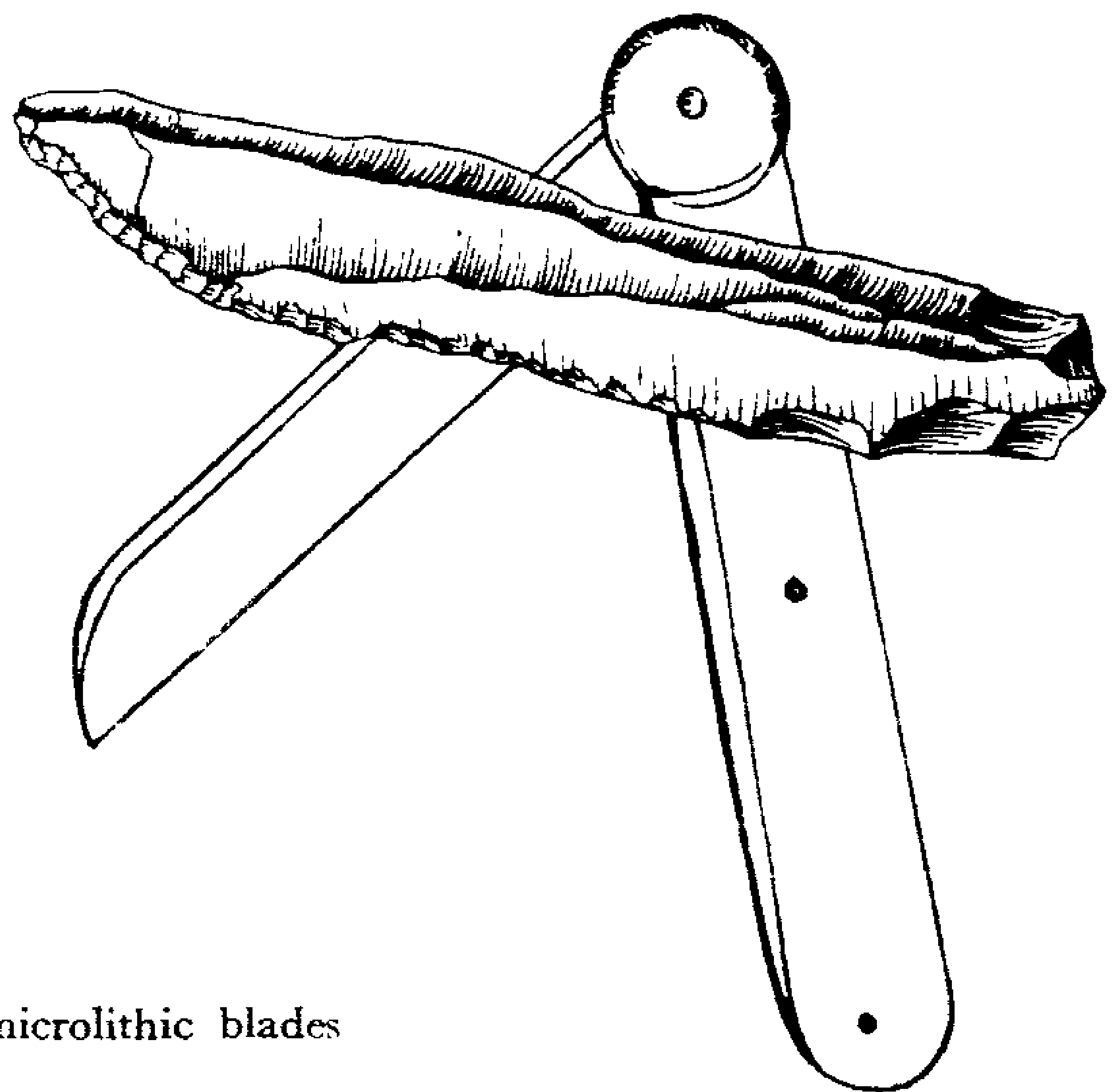


Fig. 120. Sickle made by mounting microlithic blades in a wooden shaft

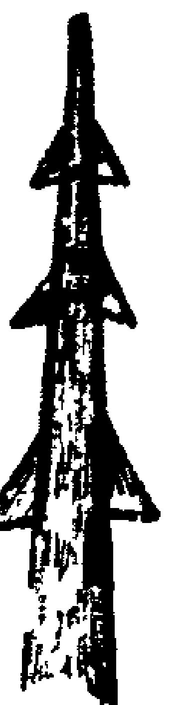


Fig. 124 1 : 2 Harpoon mounted with "Triangles"

The last stage of the Stone Age is in fact the beginning of a new stage of economic independence, and settled way of life. But here too we do not witness that complexity or that development which one does in Western Asia and Western Europe. For the polished or ground axes and adzes were never hafted in a socketed

handle or inserted in an antler sleeve nor were the former (handles) bored as in some Northern Mesolithic Cultures. Throughout India,

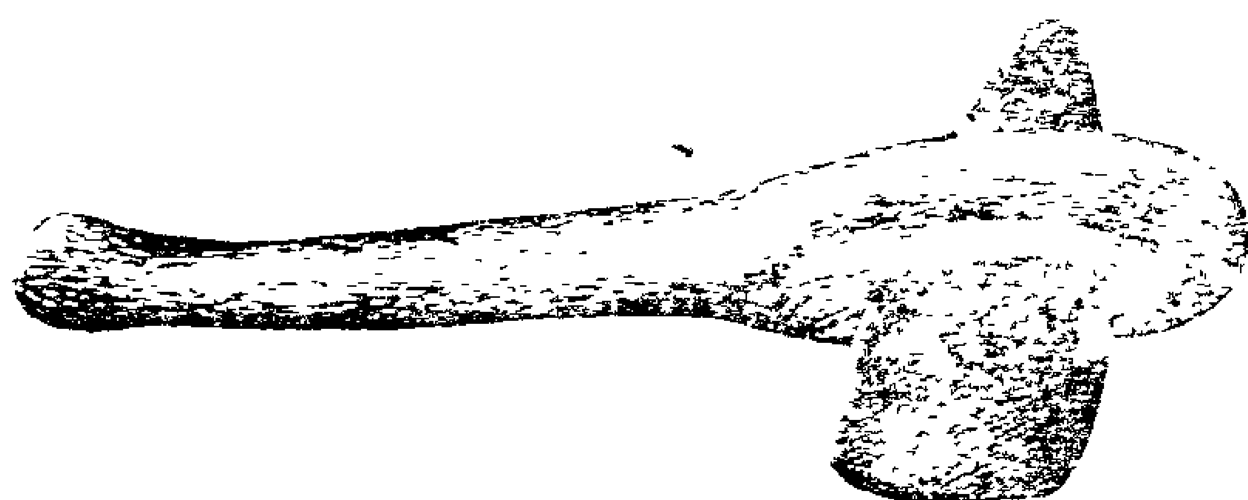


Fig. 125. Pointed butt axe hafted in a slotted handle (after Curwen) 1 : 2

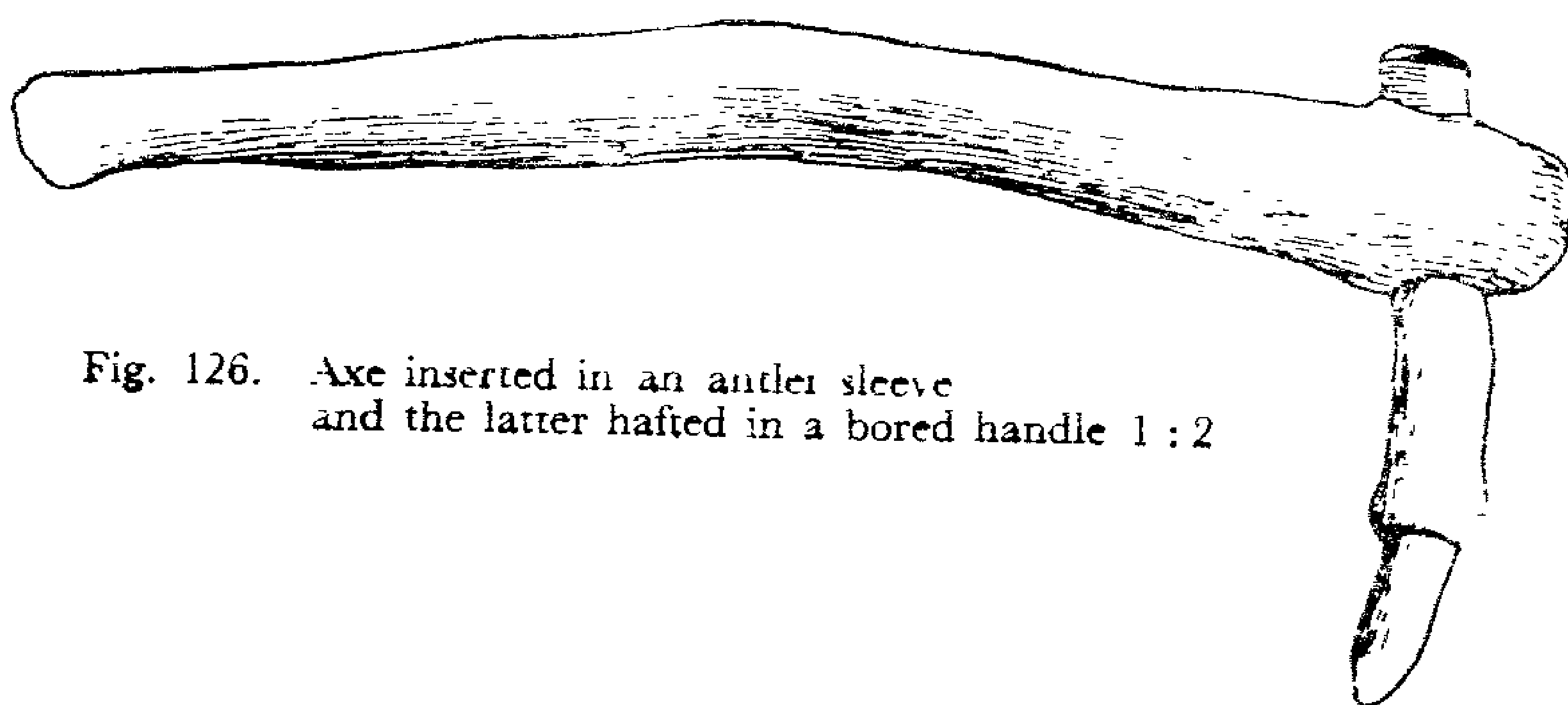


Fig. 126. Axe inserted in an antler sleeve and the latter hafted in a bored handle 1 : 2

wherever these axes were used, they must have been placed in a split wood haft and bound with a withy and further secured by some mastic (Figs. 127-128). Outside India, however, these axes

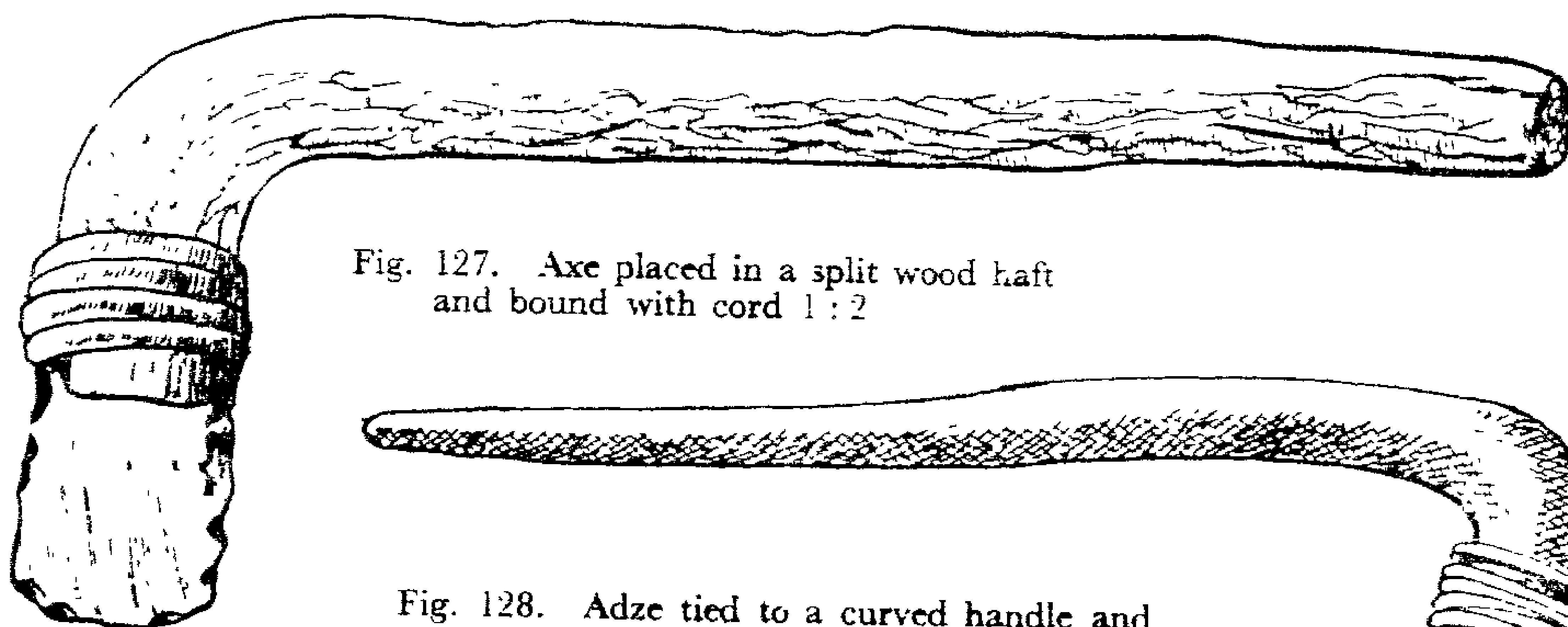


Fig. 127. Axe placed in a split wood haft and bound with cord 1 : 2

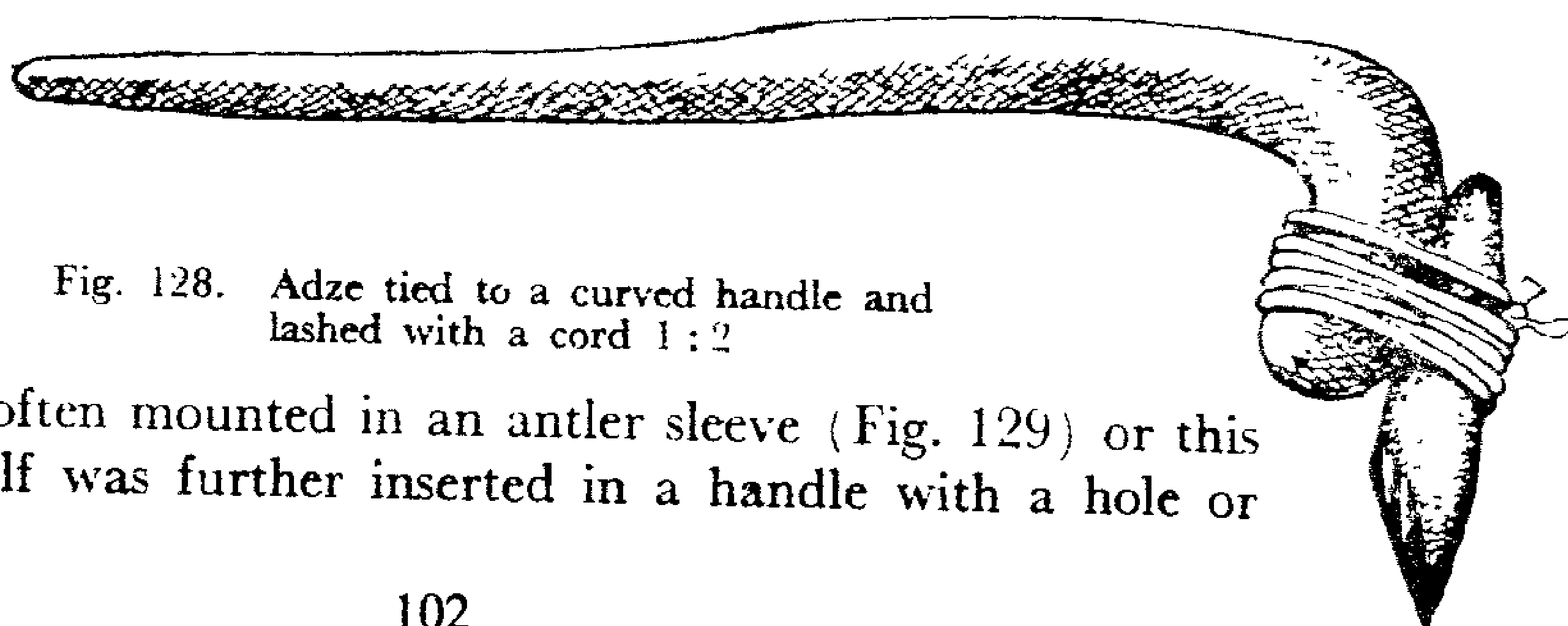


Fig. 128. Adze tied to a curved handle and lashed with a cord 1 : 2

and adzes were often mounted in an antler sleeve (Fig. 129) or this antler sleeve itself was further inserted in a handle with a hole or

in which a hole was made (Fig. 126). Thus the prototype of a modern socketed type of an axe with a long handle was prepared. The adzes were sometimes hafted as shown here (Fig. 128) just by lashing on to the stump of a right-angled wooden shaft. This method

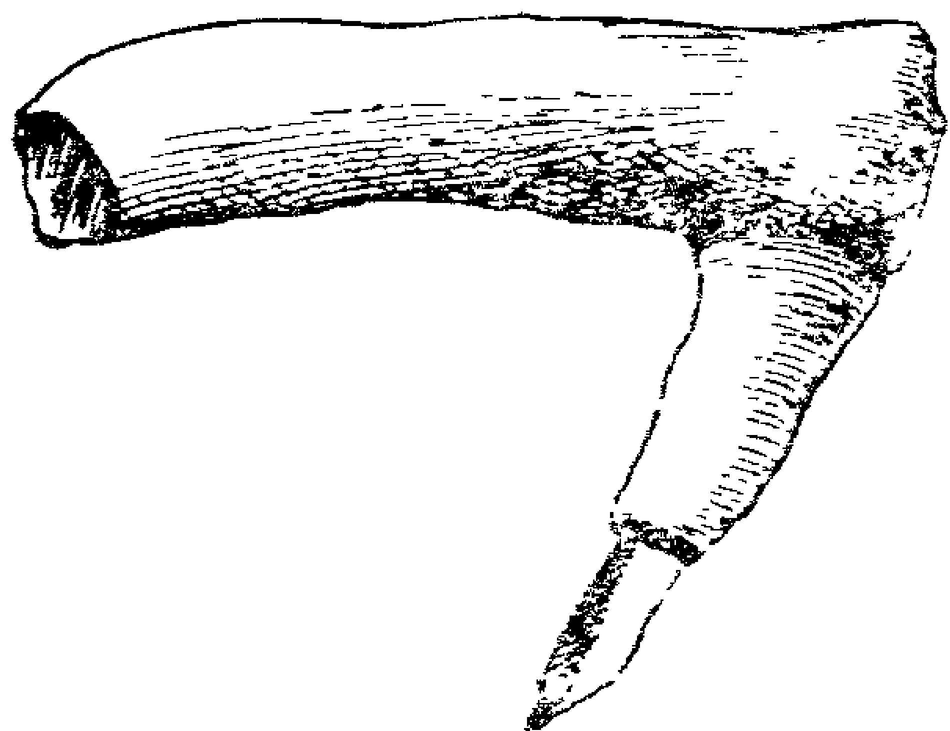


Fig. 129. Stone Axe mounted in an antler sleeve 1:2

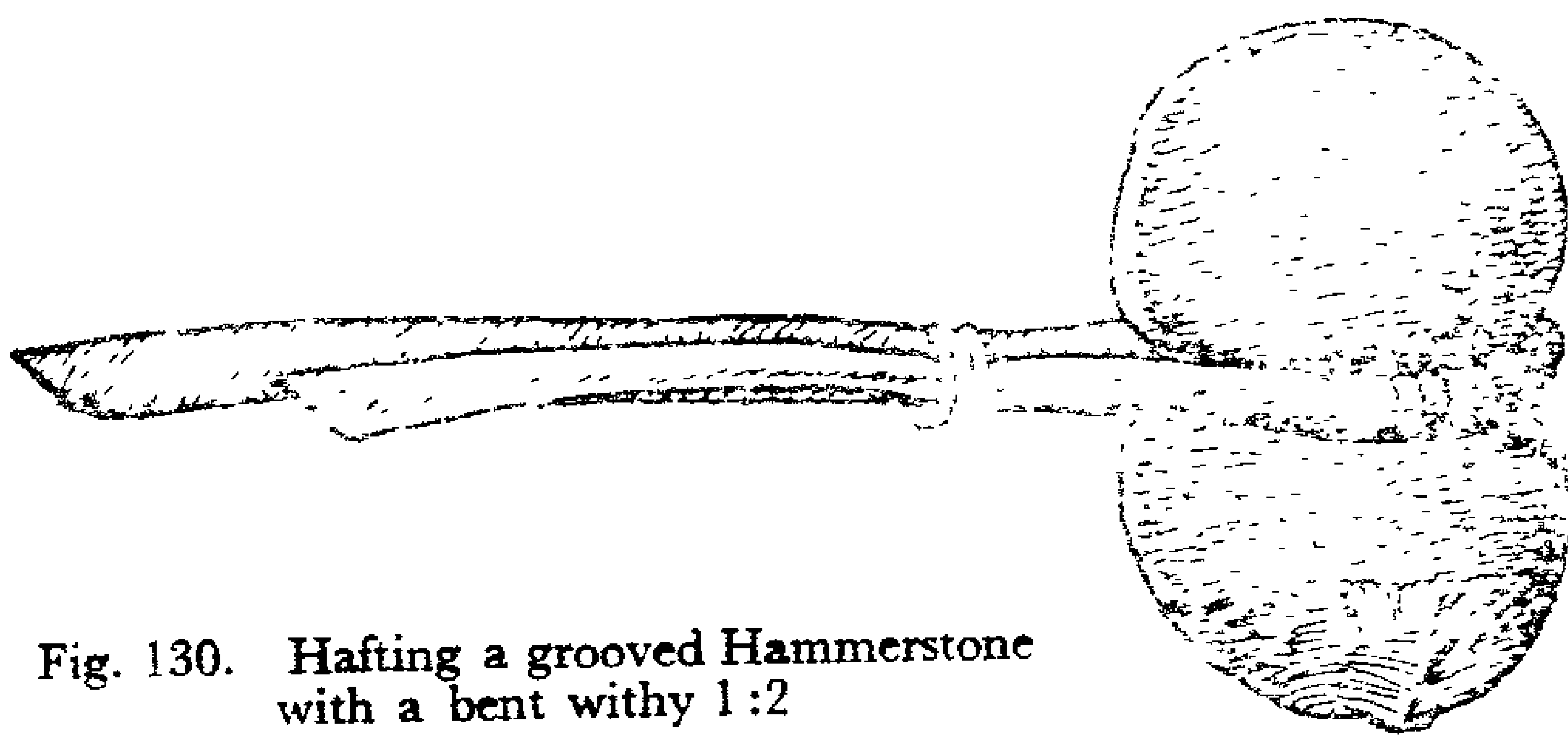


Fig. 130. Hafting a grooved Hammerstone with a bent withy 1:2

could not have been very effective. Grooved hammerstones must have been hafted as illustrated here (Fig. 130), almost exactly as the axe was placed into a withy and secured with a string or natural strand.

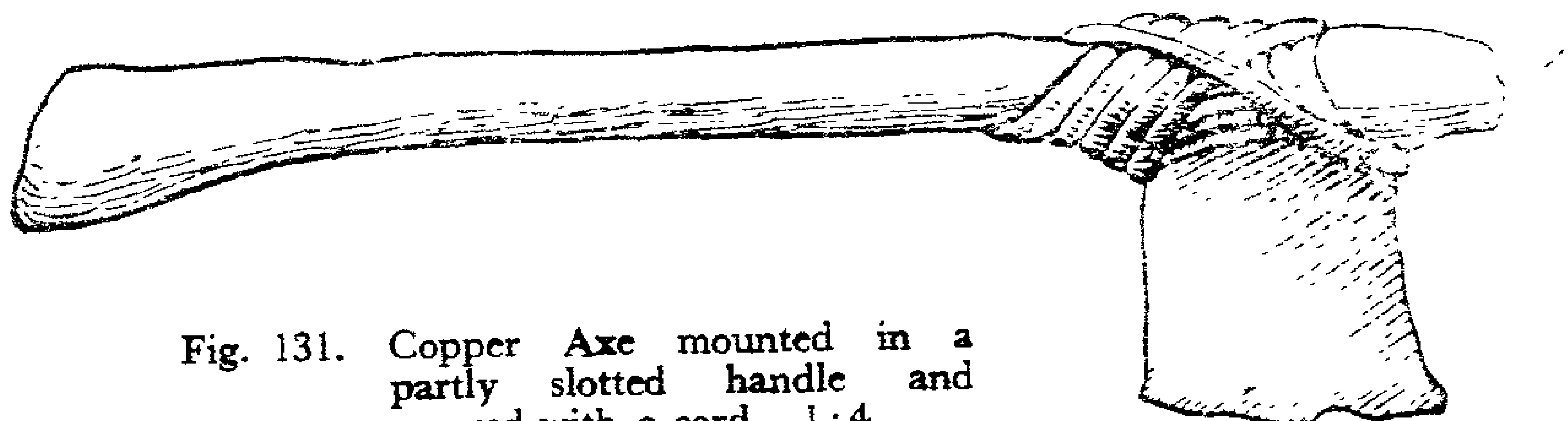


Fig. 131. Copper Axe mounted in a partly slotted handle and secured with a cord. 1:4

During the Metal Ages, tools and weapons continued to be hafted in this primitive way in India, though in Western Asia socketed tools and weapons had appeared by about 3,000 B.C. This lasted until the dawn of historical period when fresh impetus was given by contacts with the Persians and the Greeks. These improved methods persisted for a long time, until the West again outstripped India first by introducing the guns, and then modern arms and mechanical appliances during the last century. Thus greater and greater improvement is taking place so much so that most of the tools and weapons are now becoming automatic. But this is not the end. It is the divinization of the man himself.

VI

Tools and Raw Materials

Stone Age Tools bear an intimate relationship with the raw material, that is various geological formations. This is particularly so during the Early Stone Age, when the tools were comparatively large and so man could not import the pebble or rock, but had to rely upon the local material.

This is well demonstrated by the distribution of the various rock formations in India and the nature of the raw material of tools. Thus Early Man preferred quartzite, one of the oldest rocks, wherever it was available. But in the Deccan Plateau or Maharashtra, this formation is covered by the masses of lava called basalt or trap. So man was forced to use the latter material. But even here he chose the fine-grained material from dolerite, which occurs as intrusive dykes in the basalt. This was formed from fresh small outbursts from within the bowels of the earth, after the lava spread in horizontal sheets, and cooled down. These intruded almost athwart or at an angle with the horizontal lava beds. Compared with the normal basalt, this is very fine, homogeneous, hard and heavy, and yields good conchoidal fracture when intentionally broken. Very often one would find a large number of tools and their debris near a dyke. In fact this is the best way for discovering Early Stone Age Tools in Maharashtra. One such locality abounding in dykes is seen at Gangapur at Nasik; another is near Nevasa. There must be another such dyke near the Hathi well locality at Nevasa.

As we leave the basalt plateau, quartzite reappears, occasionally with other material such as quartz, fine sandstone, jasper and even the intractable gneiss. The best instance of such a varied material is North Karnatak, where in the beds of the Malaprabha the classic site of Khyad yields tools in all these rocks. Similarly it is widespread in Central India, where again we have quartzite, sandstone etc.

EARLY STONE AGE IN INDIA

IN RELATION TO RAW MATERIAL

SCALE



DELHI

CALCUTTA

BOMBAY

MADRAS

INDEX

PENINSULAR INDIA

- PLEISTOCENE & RECENT
- COASTAL — TERTIARY & PLEISTOCENE
- OLIGOCEN & LOWER MIOCENE PALAEOCENE & EOCENE
- DECCAN TRAP (differentiates in Kathiawar--stippled.Rajmahal, Abor Hills & Sylhet)
- CRETACEOUS
- UPPER GONDWANA OF THE PENINSULA LOWER " & UPPER PALAEOZOIC
- VINDHYAN, MALANI-VOLCANICS & GRANITE
- CUDDAPAH, DELHI, ETC.
- GRANITES (PURANA & ARCHAEAN)
- ARCHAEAN, DHARWRIAN, KHONDALITES, CHARNOCKITES, UNCLASSIFIED CRYSTLLNES

HIMALAYA, ASSAM ETC.

- SIWALIK, TIPAM & IRRAWADDY
- MIDDLE LOWER MIOCENE OF ASSAM & OLIGOCENE IN ASSAM
- POST PALAEOZOIC INTRUSIONS
- GRANITES & ORTHO GNEISSES
- JURASSIC, UNDIFFERENTIATED MESOZOIC, MARINE-TRIAS, MESOZOIC
- OLDER GRANITES OF DALHOUSIE-SIMLA-GARHWAL
- LOWER PALAEOZOIC & PURANA
- JUTOGH, SALKHALA, UNCLASSIFIED CRYSTALLINES

SYMBOLS

- ○ QUARTZITE, SANDSTONE & GRIT
- ● TRAP & DOLERITE
- △ GRANITE
- ▲ GNEISS & SCHIST
- □ QUARTZ
- ■ JASPER

At Lalitpur, man has preferred a fine-grained quartzite, but he has turned out equally fine tools of a relatively coarse Bundelkhand-granite (or gneiss).

The same intimate relationship with raw material one beholds in the Middle Stone Age, though the tools were smaller, and man could have, if he wished, transported to short distances, the material he liked. But he never did. Fortunately, his needs were such that he worked very fine-grained material such as flint, and in the absence of this varieties of chalcedony—like agate, jasper and chert. These he found as veins and as out-crops in several parts of India, whereas in the limestone regions in Andhra, Karnatak, Rajasthan, Madhya Pradesh and in Sind, he got flint or flint-like material. Flint is confined to certain regions only, but the chalcedonic material was more easily available, specially in the basalt area, than quartzite and dolerite. Hence the tools are found widespread in the river beds and along the foothills (the latter being factory sites). From this one may infer a larger population during the Middle Stone Age than in the earlier.

This total dependence upon the raw material seems to become less during the Late Stone Age when man does import the material he wants from a distance. Thus, in the sandy, alluvial plains of Northern Gujarat, not a piece of stone can be had. Here, man had to get chert, agate, quartz, microline (amazonite) etc. at least from a distance of thirty miles for making microliths with which the whole region is strewn. The river bed contains only large and small pebbles of quartzite. Again in the extreme South in the *teris*, man got quartz etc., whereas locally only fossil wood, chert and the like are available.[1]

During the New Stone Age man shows his preference for dolerite dykes in the granite area of Raichur, Bellary and other districts of Northern Karnatak as well as Maharashtra for making ground and polished axes, though he did use other rocks. Wherever these have been used, it undoubtedly shows foreign contacts—trade relations and/or migrations of people.

1. This was possible, as ZEUNER (1963: p. 8) has pointed out, with the introduction of the handle, the size of the working end of the tool could be reduced With the resultant saving of raw material, man's ability to penetrate into regions where raw materials was scarce became possible.

Appendix I

Further confirmation of this text book illustration was seen recently near Renigunta, Chittoor District. Here at the junction of two small rivers Kona Madngu and Ralla Kalava, about half a mile north of the railway bridge, the bed of the river was found filled up from one end to another as in Figs. 3, 5, 7 with old and new rubble cemented in dark brown and light brown gravel, these making two terraces respectively.

p. 5. *Antiquity of Man*

It was believed that Zinjanthropus was probably the oldest man's ancestor. Now Dr. LEAKEY has given up this view. According to his latest discovery in Tanganyika, East Africa, modern man had evolved from Homo Habilis (meaning 'able' or 'having ability'), who lived some 1,820,000 years ago, and who though a pygmy, about three to four feet, could probably talk, and make tools, but did not know fire. (*Times of India*, 5-4-1964).

p. 14. *Changes in sea levels*

For changes during the historic period around Italy, very convincing evidence has been collected by A. E. GUNTHER. See *Illustrated London News*, January 18, 1964, p. 86.

p. 15. *Caves and Rock-shelters in Madras and Mysore*

Caves and rock-shelters have also been discovered in these States.

About 40 miles north of Madras, a large cave near Gundiam formed in the bouldary rock formation, is being dug now.

In Mysore, caves and rock-shelters have been found near Badami, the largest being Shidalphadi, having deposits of several periods.

p. 81. *Grinding of a Stone axe and cutting a tree with it.*

It was mentioned on p. 81 that the grinding of a stone axe takes a very long time, almost three months. This observation based on the work of the New Guinea primitives needs to be modified in the light of our own experience.

While digging at the Neolithic site of Tekkalakota, District Bellary, Mysore State, one of my technical assistants, Shri P. R

KULKARNI interested himself in preparing ground axes, as all the facilities, viz. querns for grinding and blocks of diorite and dolerite were easily available. Selecting a lump of dolerite having jointed surfaces and resembling an axe, he turned it into a pointed butt axe having a sharp median edge and ground surfaces about an inch in width within six hours, just by rubbing on a quern of granite with a little water.

From this first hand experience, one can say that everywhere, all primitive people at a Neolithic stage of culture, did not take so much time for preparing a ground tool as in New Guinea.

Shri KULKARNI further hafted his axe in a slotted wooden haft and kept the axe in position by tieing it with a string. He then tried to cut the trunk of a *babul* (acacia) tree. This tree is known for its hardness, still within a few minutes a dent of nearly half-an-inch was made in the trunk, but the edge was not in the least affected.

Hafting of Early Stone Age tools

Evidence was tendered on pp. 93-4 of tools like the handaxe and cleaver which showed that they were probably hafted. Now a stone tool, (Fig. 93) with a broad, fanshaped convex edge and a well-made tang was found by Shri S. G. Supekar, one of my pupils working on the Narmada Stone Age at Dongargaon, a few miles from Hoshangabad, loosely cemented in a pebble conglomerate. This is the first time that such a tool with an undoubted tang has been found. Stratigraphically and the way it has been found, it might be placed in the Early Stone Age, but typologically it reminds us of the *much later* convex-edged, tanged copper axes from Navdatoli and the Gangetic Valley.

BIBLIOGRAPHY

ALLCHIN, Bridget

"Australian Stone Industries, Past and Present" *Journal of the Royal Anthropological Institute,* Vol. 87, Pt. 1, pp. 115-136. 1957

ALLCHIN, F. R.

"The Neolithic Stone Industry of the North Karnatak Region." *Bulletin School of Oriental and African Studies,* Vol. XIX, pp. 321-57 1957

BARNES, A. S.

"The Technique of Blade Production in Mesolithic and Neolithic Times", *Proceedings of the Prehistoric Society,* Vol. XIII, pp. 101-113. 1947

BRAIDWOOD, Robert J.

Prehistoric Men, Chicago Natural History Museum, 5th Ed. 1961

BURKITT, M. C.

The Old Stone Age, 3rd edition. Cambridge. 1955

CATON-THOMPSON, G.

"The Levalloisian Industries of Egypt", *Proceedings of the Prehistoric Society,* Vol. XII, pp. 57-120. 1946

CLARK, J. G. D.

Mesolithic Age in Britain, Cambridge. 1932

COGHLAN, H. H.

"Evolution of the Axe", *Journal of the Royal Anthropological Institute,* Vol. 73. 1943

CURWEN, E. Cecil.

"Some Food-Gathering Implements", *Antiquity,* Vol. 15, pp. 320-336. 1941

CURWEN E. CECIL,

. . . "Harvesting Implements in Denmark". *Antiquity,* Vol. 17, pp. 196-206. 1943

DANI, A. H.

Prehistory and Protohistory of Eastern India, Firma K. L. Mukhopadhyaya, Calcutta. 1960

GRAHMANN, Rudolf,

"The Lower Palaeolithic Site of Markkleberg and other comparable localities near Leipzig", edited by MOVIUS, Hallam L., Jr.

HONEA, Kenneth, H.

"Prehistoric Flaking Technologies in Texas", paper read at the Sixth International Congress of Prehistoric and Protohistoric Sciences Aug. 29-Sept. 3, Rome. 1962.

KROEBAR, Theodora

ISHI, California 1962

LEAKEY, L. S. B.

"Stone Implements—How they were made and used". *South African Archaelogical Bulletin,* Vol. V. pp. 71-74 1950

LEAKEY, L. S. B.

Adam's Ancestors, 4th edition. Methuen, London. 1953

LEAKEY, L. S. B.
"Working Stone, Bone and Wood", in *A History of Technology,* Ed. by Charles SINGER et al. Vol. 1. pp. 128-142. 1956

LOWE, C. van Riet.
"The Evolution of the Levallois Technique in South Africa", *Man,* Vol. XLV. 1945

MITCHELL, S. R.
Stone Age Craftsmen 1949

MOVIUS, Hallam L. Jr.
"The Stone Age of Burma", *Transactions of the American Philosophical Society,* Vol. XXXII, Pt. 3, pp. 341-393. 1943

MOVIUS, Hallam L. Jr.
"Lower Palaeolithic Cultures of "Southern and Eastern Asia". *Transactions of the American Philosophical Society,* Vol. XXXVIII. Pt. 4. 1949

MOVIUS, Hallam L. Jr.
"Pebble Tool Terminology in India and Pakistan", *Man in India,* Vol. 37, No. 2, pp. 149-156. 1957

NOONE, H. V. V.
"Burins and Their Classification", *Journal of the Royal Anthropological Institute of Great Britain and Ireland,* Vol. XLIV, pp. 91-92.

OAKLEY, K. P. and LEAKEY M. D.
"Report on the Excavations at Jaywick Sands, Essex", *Proceedings of the Prehistoric Society,* Vol. III, pp. 217-260. 1937

OAKLEY, Kenneth P.
Man the Tool-Maker, 4th edition British Museum (Natural History) London 1958

PATERSON, T. T.
"Core, Culture and Complex in the Old Stone Age", *Proceedings of the Prehistoric Society,* Vol. XI, pp. 1-19. 1945

SANKALIA, H. D.
Prehistory and Protohistory in India and Pakistan. (Bombay University) 1963

SEN, D.
"The Soanian and the Pebble Tool Terminology in India", *Man in India,* Vol. XXXVII, No. 2, pp. 157-59. 1957

SOHNGE, P. G. and LOWE, C. van Riet
The Geology and *The Archaeology of the Vaal River Basin*
Pretoria 1937

SOLLAS, W. J.
Ancient Hunters and their Modern Representatives, 3rd edition. 1924

STEENBURG, Axel.
Harvesting Implements in Denmark
Copenhagen. 1943

SUBBARAO, B.
"Chalcolithic Blade Industry of Maheshwar (Central India) and a Note on the History of the Technique", *Bulletin of the Deccan College Research Institute,* Vol. XVII, No. 2, pp. 126-49.

ZEUNER, Frederick E.
The Pleistocene Period (Hutchinson) London 1959

ZEUNER, Frederick E.
Environment of Early Man with special reference to the Tropical Regions (M. S. University of Baroda) 1963

INDEX

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R



S

T

U

V

W

Y

Z